

GARBAGE

THE PRACTICAL JOURNAL FOR THE ENVIRONMENT

Reusables Reappear

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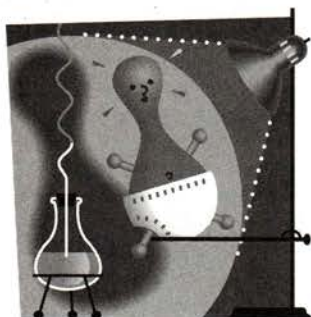
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THE ORGANIC ALTERNATIVE



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Voices of Debate

THE PREVIOUS ISSUE OF GARBAGE GENERATED A LOT OF MAIL and a surge in phone calls to the Gloucester office. Because one of the reasons I do this magazine is to provide a forum (getting people to crawl out of their comfortable stuffed chairs of ideology and wander the halls a bit), I am delighted and encouraged by the comments, opinions and controversy.

The very earliest response (mostly by phone) was overwhelmingly negative: "Cancel my subscription and tell the editor she's a traitor to the Movement!" I was saddened to find so many closed-minded people on my list, but I wasn't surprised. (If you read only what you agree with, how do you learn?) Trying to please those people was what had me pulling punches to begin with. If that fringe gets any bigger, look for book-burning to become politically correct.

The second wave was more thoughtful. I was glad to read dissenting letters that were thoughtfully considered and respectful of debate. Some readers brought up excellent observations; take the man who went beyond environmental myopia to point out that diaper services are part of local economies, while disposables belong to a centralized, corporate-run economy. And despite the dogmatism of fringe environmentalists, despite the well-known publishing truism that happy subscribers don't bother to write, fully half of the letters were positive, applauding us for trying to explain scientific principles, being courageous, and "seeing the issues through many different eyes."

Thank you.

Patricia Poore

DEAR EDITOR: I TEACH SCIENCE WITH AN EMPHASIS on environmental issues, and am uncomfortable with the attitudes of a lot of the "environmental" organizations. Students are often surprised to find their most cherished illusions ("using a paper bag instead of a plastic one means you *really care* about the environment") challenged. The articles on disposable diapers, sludge, and (especially) "The Dose Makes the Poison" were *welcome* doses of good sense.

You will probably get a lot of flak from ignorant "environmentalists" over your editorial stance, but you have made a real fan of me.

LINDA M. HILL
Bothell, Wash.

YO PAT: CANCEL MY SUBSCRIPTION RIGHT NOW, 'cuz I just got your 3rd anniversary issue and it struck me as a truly execrable and disappointing exercise in greenwashing. Why?

Let's face it: The controversy ... is about the mentality that allows us to cut down millions of trees, bleach the pulp, attach never-to-be recycled plastic, use it once and "throw it away." Not to mention the fact that much of our trash is incinerated before it's landfilled (where does the dioxin in the bleached pulp in the disposable diapers go when it's burned? Hmmm ... do you think it might go ... into the air?) and the unreliability of statistical studies.

Excuse me, Dr. [Alice] Ottoboni, if I'm a little skeptical about articles reminding me in a paternal tone how I should rely on scientific information from reliable sources to help me make judgements about toxics. It's just that I've heard that particular story before. Or perhaps it's the high levels of PCBs and dioxin in the fatty tissues of my breasts that's making me cranky.

MARY LOU JORDAN
Arlington, Mass.



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POSAL BECAME A MAJOR ISSUE.

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POUNDS OF PLASTIC

ANNUALLY, ENOUGH TO

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Made-Up Minds

THE SOONER YOUR MAGAZINE DISAPPEARS INTO the dumpster, the better. You have obviously bought every single bit of propaganda the chemical and paper industries have doled out over the past three years, to the detriment of our health and Earth's sustainability. With "friends" like you, the environment doesn't need enemies.

It would take some time to point out the dangerous deceptions in your latest issue, but it appears your mind is made up.

LIZ ARMSTRONG
Erin, Ontario

TAKING A MAJOR STAND FOR DISPOSABLES undermines your credibility and further blurs the distinction between the "good" guys and the "bad" guys in the environmental movement.

PEGGY O'MARA
Editor/Publisher, Mothering
Santa Fe, N.M.

ENVIRONMENTALISM HAS ITS OWN "POLITICAL correctness." Free speech in the United States on critical issues, by thinking, leading, working people, is being eroded because of concern [over the reactions of] a vociferous minority group of single-interest individuals.

Most approving Americans are silent: You can't hear them when they nod. Opposers specialize in unlimited shrillness to compensate for their small number. Besides, they have made up their minds, so facts are irrelevant.

JIM POWER
Memphis Botanic Garden Foundation
Memphis, Tenn.

I'VE BEEN WATCHING AS THE MAGAZINE — AND you — have undergone an exhausting growth period, trying to please everyone. I appreciated your balanced, responsible approach. When the extremes of the environmental spectrum start throwing clearly biased numbers and figures at me, I generally read with a large dose of skepticism.

Your magazine, however, lets us make up our own minds. GARBAGE is a breath of fresh air!

SUSAN B. JOHNSTON
Alexandria, Va.

Poison Pens & Praise

"THE DOSE MAKES THE POISON" SEEMED TO BE a bit toxic itself. It is *not* encouraging or trust-inspiring to note that the series heading "Speaking for Science" is derived from a line from Dixy Lee "a-little-dose-of-nuclear-waste-never-hurt-anybody" Ray.

JOHN JONIK
Philadelphia



YOUR EDITORIAL AND THE ARTICLE "The Dose Makes the Poison" by Dr. Ottoboni convinced me that [GARBAGE] was worth subscribing to. As you said, the facts won't always fit the green agenda.

Dr. Ottoboni concluded her article saying, "Investigating all sides of issues means not falling for those that fit our current biases. An informed person is not at the mercy of propagandists — on either side." I say right-on with that thinking, and right-on with your magazine, which we have decided to continue receiving.

WENDY MARTIN
Havana, Ill.

Points of View

YOUR OPENING ARTICLE IN THE OCT/NOV ISSUE attempts, successfully I think, to bludgeon some sacred cows in the diverse environmental community. Keep it up. The public needs more clearheaded writing.

You also make an important statement about what is the greatest environmental threat

facing the world today: population. To a large extent, population issues are seen as relevant only to the developing world and not the United States. This is clearly a mistake.

Our political leadership has failed to grasp either the significance or the enormity of the problem population growth poses. Political debate in the U.S. has often been framed in the notion that we have abundant "open space." Yet there has never been any serious inquiry by Congress to delineate the multiple ramifications of resource use, consumption, degradation, and the role of population on carrying capacity.

We should be moving vigorously to stabilize our population, not increase it, and ultimately to match it to our carrying capacity. Any other course leads inexorably to a lower standard of living and a lower quality of environment. Indeed, the population of the U.S. already exceeds its carrying capacity — that is to say, our current population is being sustained by continued erosion of our resource base.

The Wilderness Society is embarking on a major two-year program to improve public understanding of the impact of population growth. Given the tone of your concern, I look forward to many articles in GARBAGE on this issue in the years to come.

GAYLORD NELSON
The Wilderness Society
Washington, D.C.

Mr. Nelson, former U.S. Senator from and governor of Wisconsin, was the founder of Earth Day. He is now counselor to The Wilderness Society.



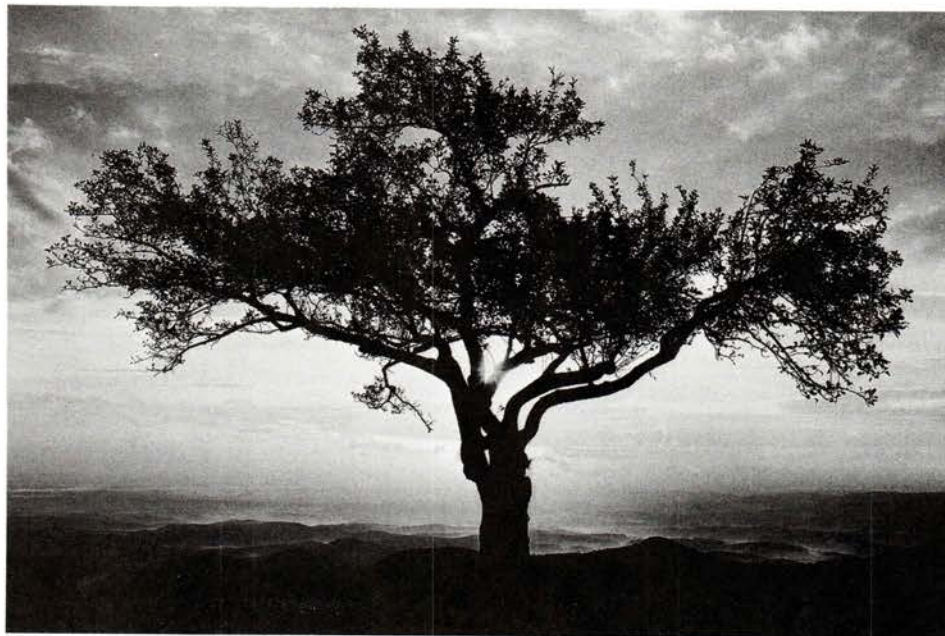
"Your magazine lets us make up our own minds."

YOUR MAGAZINE SEEMS TO MISS THE POINT ON the disposable-diaper issue and possibly the whole garbage issue. The issue we are concerned about is that we have become a disposable society completely dependent on disposable everything. We (many of us) believe that by recycling, source reduction, and common sense we can become less dependent on disposables.

REBECCA CARLBON
Ocean City, N.J.

BRAVO! BRAVO! BRAVO ON THE DIRECTION YOU are going with GARBAGE. It's always wonderful to watch somebody trying to be *ratio-*

WE'VE HELPED OVER 600 COMMUNITIES PROTECT THE ENVIRONMENT.



It's a fact. American homes contain dozens of household waste products. A lot of that seemingly harmless stuff we've got lying around the garage, basement and under the kitchen counter is dangerous hazardous waste. It is estimated that the average household contains ten to fifteen gallons of waste materials.

Many concerned community groups and city leaders are actively seeking ways to organize collection programs to prevent household hazardous wastes from finding their way into local sanitary landfills and water resources. That's why more and more communities are calling Laidlaw.

Laidlaw Environmental Services is one of the nation's largest organizations committed to the effective management, transportation and disposal of household hazardous waste. Across the nation,

we've helped create responsible community partnerships to educate people about the dangers of household hazardous waste. We've also organized and participated in hundreds of waste collection programs.

So, if your community is thinking about organizing a household hazardous waste collection program, or if you'd like to know more about how Laidlaw Environmental Services can help, call 1.800.356.8570. Our Manager of Household Hazardous Waste is available to answer all your questions about conducting a waste collection program in your community.

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nal, and it's very heartening to see you trying to keep the baby while tossing out the dirty bathwater of the environmental movement.

CARL RAMON
Anchorage, Alaska

YOUR ISSUE WAS OUTSTANDING FOR ITS articles that spoke expertly on very controversial topics. I enjoyed the cover story, but would have voted for "Sludge" or "The Dose Makes the Poison" to take its place. The latter two articles provide readers with information on subjects where there is a tremendous amount of fear and misunderstanding. Thank you for publishing them. I intend to use them as reference materials.

JACQUELINE A. BOGARD
*Director, Environmental Programs
Del Monte Foods
San Francisco*

IT SEEMS THAT MAINSTREAM AMERICA IS only willing to go so far in preventing ecosystem degradation. The boundary starts where convenience ends. Exploration beyond is left to that small minority of us who really do care enough to stray from the herd. For example, the reason I never heard of Velcro-closure diaper wraps is because my wife knitted wool diaper covers.

In other words, Patricia Poore, your understanding of the alternatives is narrow. If GARBAGE is going to survive as a meaningful voice of environmentalism, you're going to have to stop making up excuses for unnecessary consumption (e.g., air conditioning), and start exploring and advocating workable alternatives, whether yuppies like them or not.

JOSEPH JENKINS
Grove City, Penn.

AS FOR POOH-POOHING EMOTIONALISM, TREAD lightly. That emotionalism spurs people into taking action, causing them to seek new, low-impact ways to live on the Earth. And no matter how uncomfortable it is to admit, some people are being harassed by the government for their pro-environment stance. If you find that hard to believe, just remember that Martin Luther King was treated as a subversive by the FBI.

MARGARET LION
Philadelphia

Other People's Stories

I HAVE BEEN INVOLVED FOR ALMOST TEN YEARS IN efforts to have an invasive grass controlled in the intertidal land of Willapa Bay, Pacific County, Washington. Along the way, I and others have refused to let the extreme elements of the environmental community dictate: Our primary reason for staying open-minded was to avoid tossing out *all* available control methods on philosophical grounds — something these people are very capable of doing.

In resisting, I have found myself called a "hysterical anti-environmentalist," among other names. These name-callers, in the majority, drive cars, are "organic" gardeners who use nicotine (among other natural pesticides) and take antibiotics when prescribed. From my experience with this fringe, your points on logic and the careful application of research methods to environmental problems will fall on deaf ears attached to virulent mouths. Your opening cannonballs were great. I am looking forward to the next round.

KATHLEEN SAYCE
Nahcotta, Wash.

IN RELATION TO YOUR EDITORIAL, NO MORE *Pulling Punches*: After five years of watching the debate [as a journalist] over our waste district's state-of-the-art incinerator, I could no longer support the environmental distortions that a handful of incinerator opponents in this area were handing out. After I confirmed they were publishing outright lies in their letters to the editor, I began openly contradicting their claims.

Their tactic in fighting the Wheelabrator [plant] over the past five years has been to continually file suits and administrative appeals against their own solid-waste district (not Wheelabrator), harass district representatives, and disrupt meetings in an attempt to undermine the district and drive up costs to discredit incineration. In like manner they began harassing me, denouncing me at public meetings, and harassing my editor claiming I was biased (while never really contradicting specific information). Eventually my editor pulled [my coverage of solid-waste issues].

To think that five years ago I signed a petition with these people against the incinerator. What I have found is that these state-

of-the-art facilities are the best option for non-recyclable trash.

I've also learned that I'd touted too many environmental arguments that were questionable at best and flat wrong at worst. I began taking my own stance for granted just because I believed in it.

RAYMOND HUGHES
Claremont, N.H.

I COMPLIMENT YOU FOR YOUR POSITION OF NEUTRALITY. The most important contribution a publisher can make is an attempt at fairness.

I've considered myself an "environmentalist" for a long time. And I spent several years as an activist and grassroots nuclear arms control organizer. Many very well intentioned people working toward these kinds of important goals have become what they say they hate — prejudiced and intolerant.

I currently work for the national communications organization for nuclear energy (USCEA). I've had people question my integrity and character for making a decision to support what I believe is a positive application of nuclear technology. And yet I'm continually amazed at how little anyone knows about it. I would be sorry to see this technology trashed out of ignorance. Those who say they want to solve problems work to create and magnify them. I don't see a conflict between renewable technology and nuclear energy — I believe we need both. The "we" versus "them" mentality is a distraction.

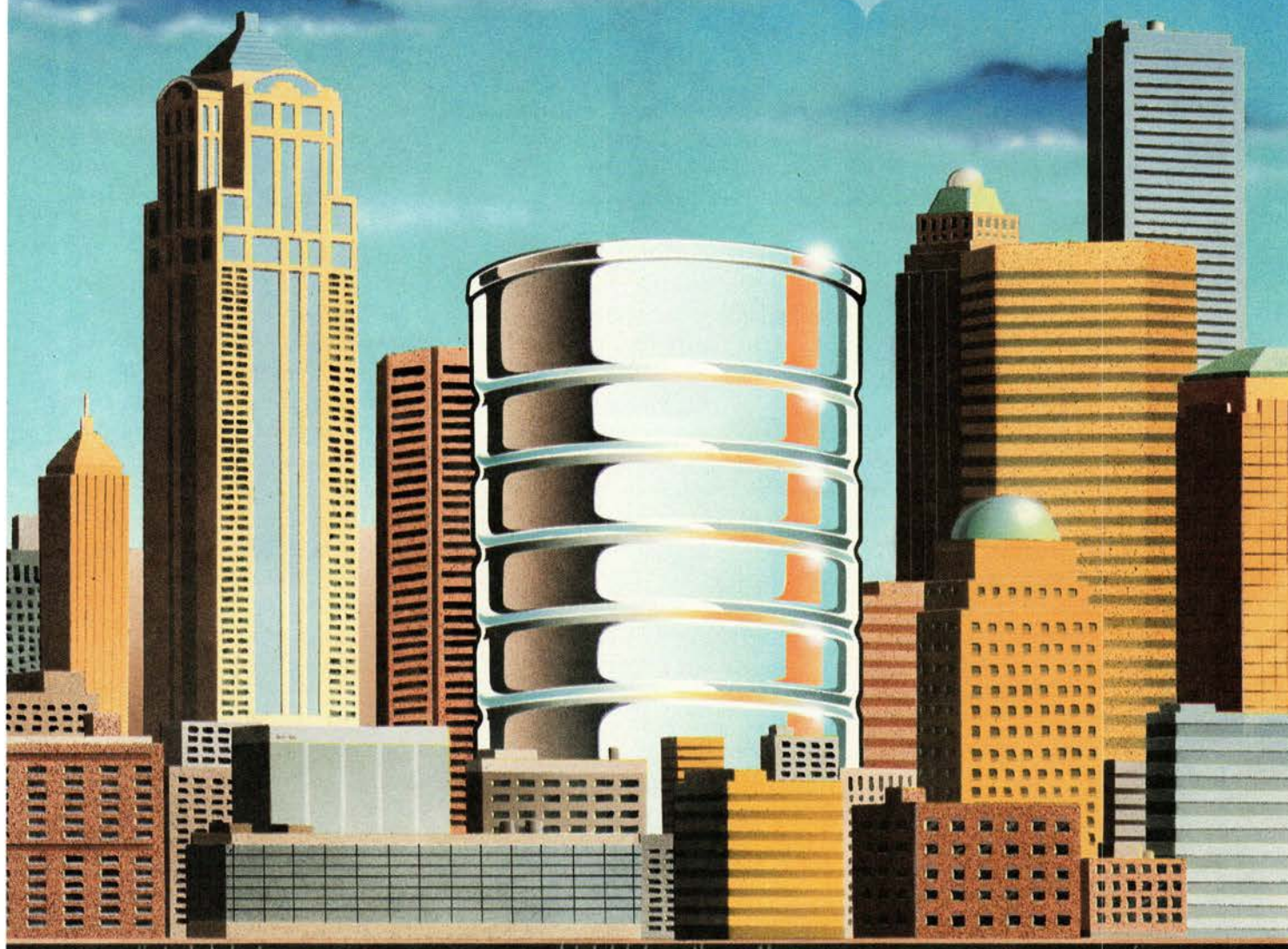
But it's refreshing to know that there are people — communicators — willing to look at the many sides of issues and try to sort them out. The most any of can ask is that you try to see through many different pairs of eyes.

MARK RICHARDS
Washington, D.C.

The Diaper Wrangle

CONGRATULATIONS ON YOUR COURAGEOUS ARTICLE. There was some language, however, in William Rathje's column that I found objectionable and misleading. "For disposable diapers, the bulk of the energy used occurs during manufacturing. At this state, there is also a likelihood that some pollution will occur." Based upon everything I know, there is much more than a likelihood, there is an

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absolute certainty, and to the degree that the pulp is refined with the use of chlorine bleach, some degree of dioxin would be released into the environment.

GARBAGE remains my favorite environmental magazine.

JEFFREY HOLLENDER
CEO, *Seventh Generation*
Colchester, Vermont

YOUR DIAPER ARTICLE IS REFRESHINGLY FRANK and honest. You are to be congratulated for your courage to change your opinion on a volatile topic and to be able to see beyond the heated rhetoric of the time to a balanced assessment of claims. Thank you for your contribution to balanced reporting.

DR. RICHARD H. NURSE
Polymer Technology Services
Acton, Mass.

COST AND ENVIRONMENTAL FIGURES FOR CLOTH diapers are based upon the notion that all materials are purchased new. Friends gave me three dozen used diapers. I purchased another dozen still in the wrapper at a garage sale for \$3. Choosing cloth allows a mother the option to be economically and environmentally resourceful. Choosing disposables does not.

PATRICIA TAYLOR
Minneapolis, Minn.

WHAT'S GOING ON? IS PROCTER & GAMBLE A new sponsor?

DEBORA STAFFORD
Niwt, Colo.

I BELIEVE THAT MAGAZINES WHO HAVE SOLD out to placed advertising, like GARBAGE, will be big losers.

STEVE HONER
Apple Valley, Minn.

For the record, we have accepted ads for cloth diapers and wool diaper covers, but you've never seen a disposable-diaper ad in GARBAGE. I would have accepted such advertising, but nobody's offered to "buy us."

— W.J. O'DONNELL

PATRICIA POORE'S DIAPER COVER PIECE STIRRED UP some heat around here, got some green knees

jerking. I, for one, think she's right on, especially re the tactics "green" organizations use, and the generally repressive P.C. atmosphere among such folk. It was a gutsy position to take, and I'm interested in what the readership and press fallout will be.

JERRY HOWARD
New Age Journal
Brighton, Mass.

WHAT RATHJE AND MURPHY DISMALLY FAIL TO point out is this: Disposable diapers, along with newspapers, paper bags, and everything else buried in landfills don't decompose. The Garbage Project can tell us what is in a landfill is because the subsurface material looks just like it did ten years ago and it will look like that in a hundred. If that doesn't strike anyone as wrong, or at least odd, then how does your brain work?

PETER STEKEL
Seattle, Wash.

Your information about slow biodegradation in landfills comes from Dr. Rathje's Garbage Project research.

— THE EDITORS

O BVIOUSLY, AS EDITOR OF A MAGAZINE read largely by environmentalists, the environmental integrity of your personal life is going to be evaluated. If you cannot stomach an evaluation of your actions, then edit your magazine under a false name and do not agree to interviews.

RAYMOND V. OJA
Yorba Linda, Calif.

MY COMPLIMENTS ON A WELL-WRITTEN, PERSONAL essay. Frankly, I am very tired of being inundated with rhetoric implying that landfills and recycling are the end-all environmental issues of the century. Lately, I find myself making politically incorrect comments like, "We have limited financial resources; should they be directed to subsidize the collection of mixed waste paper (which has a very limited market in Seattle), or should they be used to combat illiteracy or should they be used to improve water resources man-

agement to forestall Endangered Species Act remediation for fisheries?" We must make some choices about priorities — based on risk, not symbols! Keep it up!

KATHY E. GILL
Northwest Pulp & Paper
Bellevue, Wash.

I WAS SHOCKED TO READ PATRICIA POORE'S commentary. Poore's observations seem to dismiss the issues raised against disposable diapers from within the isolation of the individual. The continued reuse of cloth diapers is supported by local business using local labor and services to wash and care for diapers. (A typical diaper service in this country serves three to four thousand families and employs thirty to forty people.) The majority of money spent on disposable diapers goes towards acquiring wood pulp and plastics, transporting raw materials and finished products to market, and, let us not forget, advertising costs and corporate-office paychecks. Very little of the \$3.3 billion Americans spent on disposable diapers last year stayed in communities that not only purchase the products, but must also pay for their disposal.

TIM SWOPE
Institute for Local Self-Reliance
Washington D.C.

CAN YOU IMAGINE BURYING THE DISPOSABLE waste created by your baby in your own back yard?

CONNIE SUTTON
Menlo Park, Calif.

No — nor can I imagine growing the cotton for cloth diapers in my own back yard.

Hyperbole clouds the issues. — P. POORE

A GLARING OMISSION FROM YOUR SOAPBOX addendum to "Diapers" was in the sentence, "Many problems can be solved in a country with . . . [a] regard for human rights." Come on, Ms. Poore, species-ism isn't P.C.

The obviously poured over [sic] harangue ignores the fact that the most important thing an individual can do is adopt a vegetarian diet.

CHRISTOPHER MIDDINGS
Alexandria, Va.

Sponsor a Child for Only \$12 a Month.

At last! Here is a \$12 sponsorship program for Americans who are unable to send \$20, \$21, or \$22 a month to help a needy child.

And yet, this is a full sponsorship program because for \$12 a month you will receive:

- a 3½" x 5" photograph of the child you are helping.
- two personal letters from your child each year.
- a complete Sponsorship Kit with your child's case history and a special report about the country where your child lives.
- issues of our newsletter, "Sponsorship News."

All this for only \$12 a month?

Yes—because Children International believes that many Americans would like to help a needy child. And so we searched for ways to reduce the cost—without reducing the help that goes to the child you sponsor.

For example, unlike some of the other organizations, your child does not write each month, but two letters a year from your child keep you in contact and, of course, you can write to the child just as often as you wish.

Also, to keep down administrative costs, we do not offer the so-called "trial child" that the other organizations mail to prospective sponsors before the sponsors send any money.

We do not feel that it is fair to the child for a sponsor to decide whether or not to help a child based on a child's photograph or the case history.

Every child who comes to Children International for help is equally needy!

And to minimize overseas costs, our field workers are citizens of the countries where they serve. Many volunteer their time, working directly with families, orphanages and schools.

You can make a difference!

\$12 a month may not seem like much help to many Americans, but to a poor family living on an income of \$1.50 or \$2.00 a day, your sponsorship can help make all the difference in the world.

Will you sponsor a child? Your \$12 a month will help provide so much:

- emergency food, clothing and medical care.
- a chance to attend school.
- help for the child's family and community, with counseling on housing, agriculture, nutrition, and other vital areas to help them become self-sufficient.

A child needs your love!

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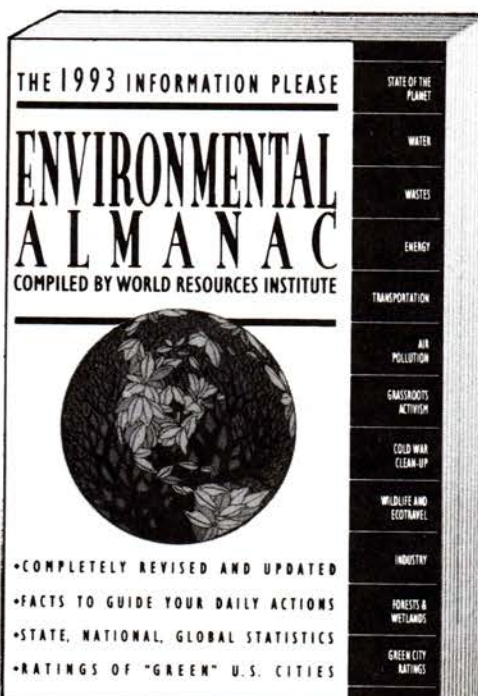
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Lifting the Lid

URBAN PLANNING

Circling Cities to Corral Urban Sprawl

IF "LANDSCAPE ARCHITECT" CONJURES A green-thumbed designer fascinated by azaleas and gazebos, you haven't met Phil Lewis, a University of Wisconsin professor who concentrates instead on urban sprawl.

Prof. Lewis, an affable, soft-spoken 67-year-old, worries that houses, roads, and shopping centers are gobbling up rural areas that cities need for their clean water, food, and places for relaxation. Without intelligent, regional-scale planning, he says, the countryside will be endlessly "nibbled away."

His opposition to boundless urban growth is hardly unique, but he proposes an intriguing, solution-oriented analysis to the blacktopping of America.

The analysis depends on 23 patterns he first observed while looking at lights on nighttime, satellite photos of the U.S. Cities are arranged in broad patterns, he decided. But what kind of patterns? He connected the dots on a map, drawing a line between cities with a population over 20,000 in a given geographic area, and noticed that cities have arranged themselves along loops and corridors.

Prof. Lewis dubbed these patterns "constellations," and says 85 percent of

the nation's population resides in them. Elsewhere, he notes, the country is sparsely populated, because hostile terrain (mountains, hills, and deserts) makes it difficult to site buildings and roads.

Why not, he reasons, set aside these under-developed regions to protect an entire area's natural heritage and put a cap on unfettered growth?

As an example, he points to his home constellation. Dubbed "Circle City," it extends from Chicago to Milwaukee, northwest to Minneapolis and St. Paul, south to Davenport, Iowa, and east again to Chicago. The "hole in the donut," as Prof. Lewis calls the interior of Circle City, encompasses southwest Wisconsin. Unlike the rest of the upper Midwest, whose poolable landscape was scalped

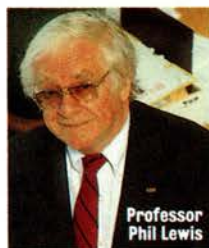
flat by a glacier's incalculable force 10,000 years ago, this chunk of Wisconsin has



steep hills and valleys. Because the area is difficult to farm, its economy is sluggish and its picturesque towns have resisted change.

The upside: Natural and economic forces have combined to make southwest Wisconsin an ideal "green lung" and retreat for the 17 million inhabitants of Circle City. But the area can remain that way only if its natural and cultural landmarks — towns, orchards, trout streams — are preserved.

However elegant this organizing principle may be, it could [Cont. on p. 16]



Professor Phil Lewis

[Cont. from p. 15] become an impotent exercise in "academic bioregionalism" if it isn't put into political play. To Professor Lewis, that means trying to educate the public about the consequences of various political, economic, and personal choices for the landscape.

This led him to establish "environmental awareness centers" — low-budget versions of a bioregional Disneyland. In his first center, built at University of Wisconsin-Madison in 1967, two- and three-dimensional maps portray the web of natural and artificial features throughout southern Wisconsin — such as old grain mills, historic restorations, waterfalls, and Indian effigy mounds. Some displays, now two decades old, show his proposal for a 23-mile green corridor of cultural and natural features around Madison. This vision is close to being realized. The nearly-completed walkway wends its way among such wonders as the sewage-treatment plant, wetlands, and parks.

State Rep. Spencer Black, a leading Wisconsin environmentalist, calls Prof. Lewis "a visionary" whose ideas have helped shape nature-preservation in the state. As evidence, Mr. Black points to the 1989 state law protecting 80,000 acres along 92 miles of the Wisconsin River, which flows through the middle of Circle City. The contentious bill passed the Legislature because "Lewis motivated many of the people who helped get it passed," Mr. Black says.

Because many constellations spill across state borders, regional plans can be stymied by politics-as-usual. Prof. Lewis acknowledges that good answers to the hard questions he poses will not come easily. "The most serious [environmental] threat is land use," he says, "but many politicians don't want to touch it, don't want to tell people how to utilize their land."

— David Tenenbaum

Based in Madison, Wisconsin, David Tenenbaum is the author of "Sludge" (Oct/Nov '92 Garbage).

This Just In...

☞ **Oh No ... Not That!** *State Legislatures* magazine reports that an Ohio court recently convicted the president of a dry cleaning supply company on counts of illegal waste storage and disposal, illegal transportation of hazardous waste, and falsifying records. The punishment? In addition to 8 years in prison, 1,000 hours of community service, and \$2 million in fines, he was ordered to become a member in good standing of the Sierra Club.

☞ **Garbage or Garden State?** Pop quiz: What state has the highest recycling rate in the country — Washington? Minnesota? According to a new EPA report, it's that state most associated with garbage — New Jersey.



In 1990, the Garden State recycled a hefty 34 percent of its municipal solid waste. (In 1985, the number was 9 percent.) To the delight of Midwesterners, New Jersey also reduced its garbage exports by 4 percent. (Twenty-two percent of N.J.'s waste is trucked to states like Ohio and Indiana.) Some bad news: Overall waste generation in N.J. was up 3.5 percent over 1989, and almost 30 percent from 1985.

☞ **Rose-Colored Trash** If you want your old specs to see the world rather than the inside of a garbage bag, drop them off at a LensCrafters store before New Year's Day.

The Lions Clubs International, with LensCrafters, collected 400,000 pairs of old glasses last year, classified them by prescription, and doled them out to four-eyes in such countries as Panama and Brazil. The prescriptions can't always be matched exactly, but any glasses wearer will assure you that the old backup pair is a vast improvement over no glasses.

☞ **Rotting Garbage Fuels Garbage Trucks** Closing the loop will get a new twist from a Cleveland company that has developed a technology to refine gas from landfills.

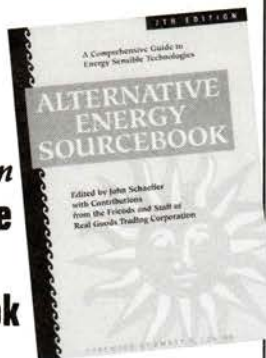
The process separates CO₂ and trace contaminants from the methane produced by degrading trash, which can then be used as liquid natural gas. The first planned application: a fleet of garbage trucks fueled with refined methane. Acrlon Technologies and the Consolidated Natural Gas Co. plan to have modified trucks tanking up with liquid methane at landfills within the next three years. A landfill with 5 million tons of trash (not uncommon) could provide enough natural gas to fuel 200 refuse haulers or 3,600 cars per day, according to William R. Brown, Acrlon's president.

☞ **Futuristic Futon** "Frog fur"? "Poly-wog"? Sound like anything you'd use to cushion your weary bones? Rest assured — the fluffy fiber, made from used polyethylene soda bottles, was finally christened "Cloverfill." A small family business in Bend, Ore., is stuffing the stuff into futons. The PET fiber weighs less than cotton and springs back to shape faster. If you'd like to roll in the Cloverfill, contact Rising Star Futons, 550 S.W. Industrial Way, Box J, Bend, OR 97702; (503) 382-4221.

☞ **Rooting for Computing** Thanks to built-in inefficiencies, computers in this country waste 20 to 25 billion kilowatt-hours a year, along with outputting six million tons of global warming carbon emissions a year and additional sulphur and nitrogen pollutants. A new federal program is aiming to save up to 90 percent of the energy squandered by some of the nation's 30 or 40 million computers. The EPA is working with manufacturers to build computers that will not only run more efficiently, but will power themselves down when we lame-brain humans exit without hitting the switch. In June, watch for models sporting the Energy Star Pollution Preventer logo. ■



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The Garbage Index

Garbage Tab

Estimated U.S. solid-waste generation, 1988:

179.6 million tons

Estimated U.S. solid-waste generation, 1990:

195 million tons

U.S. recycling rate, 1988: **13 percent**

U.S. recycling rate, 1990: **17 percent**

Portion of yard waste composted, 1988: **2 percent**

Portion of yard waste composted, 1990: **12 percent**

Number of states that recycle more garbage than they burn: **32**

Number of states that recycle more than they landfill: **0**

Number of states sending 85 percent or more of their trash to landfills: **25**

Number of states sending 60 percent or less to landfills: **8**

State discarding the most solid waste: **California**

State discarding the least: **Wyoming**

Solid waste Rhode Island discards in a year:

1,200,000 tons

Solid waste Alaska discards in a year: **500,000 tons**

Sources: EPA, Worldwatch Institute, BioCycle magazine

.....

Nuclear Numbers

Annual radiation-exposure limit deemed safe for nuclear workers: **12,000 millirems***

Average individual annual exposure to radiation in U.S.:

360 millirems

All natural, annual background radiation: **300 millirems**

Radiation dosage of one chest x-ray: **6 millirems**

Radiation dosage of one round-trip, cross-country flight: **5 millirems**

Annual additional radiation absorbed by living in Denver versus Washington, D.C.: **70 millirems**

Annual additional radiation absorbed by living in a brick home versus a wooden home: **10 millirems**

Natural radioactive materials in the body: **40 millirems**

Average from medical exams, annually: **50 millirems**

*A measure of radiation dose in terms of its effect on the human body.

Sources: General Accounting Office, League of Women Voters, USCEA.



"Dismantling Nuclear Power Plants" (March/April '92) The



pace for nuclear-power plant closures seems to be picking up. Three nuclear plants have been closed or slated for premature closing since our article went to press, and one more faces the possibility of a similar fate.

The 32-year old Yankee Rowe plant in Massachusetts had been touted by the industry as the first of a generation of older plants which would be reauthorized for 20-year extensions on their 40-year operating licenses. Instead, Yankee Rowe pulled the plug last February when the enormous cost of retooling made it economically unfeasible for the plant to continue operating. Credit climbing operating and maintenance costs for the demise of California's oldest nuclear-power generator, the San Onofre Unit 1, which is planning an imminent (and premature) shutdown; and Oregon's one nuclear facility, the Trojan plant, which is slated to close in Spring, 1996 — to be replaced by wind power and energy-efficiency programs.

Funeral preparations could also soon be underway for the Fort Calhoun plant near Omaha, Nebraska. Its parent utility reports rising costs that are difficult to justify when compared with cheaper energy-alternatives.



"A Garbage Christmas" (Nov/Dec '91) Consumerism and waste



continue to battle it out with peace and harmony for the spirit of the winter holidays. Plenty of excess packaging, wrapping paper, gifts, and ornaments will be gracing landfills by the time New Year's Day rolls around. Large numbers of Christmas trees, however, are being successfully recycled.

According to the The National Christmas Tree Association, over 4,500 communities have X-mas tree recycling programs. (Mid-size communities seem to be more successful than big cities.) Two of the most popular end-uses are wood chips for parks and other public landscaping, and fortifying dunes along beaches. Greeting-card recycling is also on the rise. Residents in Onondaga County, New York, collected five tons of greeting cards last year — that's 370,000 cards — and shipped them to a home for emotionally disturbed children in Nevada. The kids cut them up and make new cards out of the old ones.



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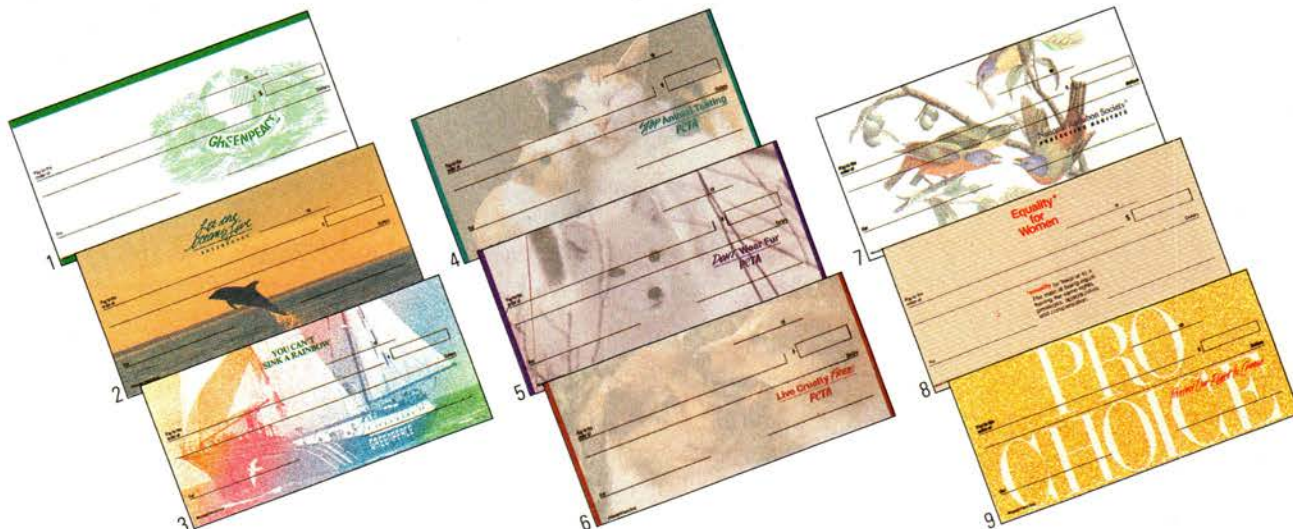
Steve Sawyer, Executive Director, Greenpeace Int'l.

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Alex Pacheco, PETA Chairperson

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Molly Yard, President, NOW



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TECHNOLOGY

Inventor Creates an ATM for Recyclers

WHAT EATS JUNK, SAYS THE same things over and over, weighs a ton, and sits all day and night outside a grocery store?

It's the Recycling Eagle, an all-in-one recycling machine created by Steve Aslanidis, a central California recycler/inventor extraordinaire. The one-of-a-kind machine uses a system of electric eyes and sensors to recognize cans, bottles, and plastic containers and decide whether they're redeemable for cash. Its got a video monitor that displays current prices for recyclables and tallies the customer's total. It even talks to you.

The Eagle has been recycling containers for a couple of years now, fronting 20 grocery stores along California's central coast. Another 25 machines are being manufactured for use at a large southern California chain of markets.

The machine bears the mark of an inventor with a vivid imagination. Mr. Aslanidis is a wiry, 51-year-old dynamo who has taken a scrapyard in a tiny town called Nipomo and in 20 years turned it into a booming recycling enterprise.

"I'm just a recycler at heart," he says while fielding phone calls and interruptions in his hectic office. In the yard outside, a glass crusher roars at high decibel, which is reduced just slightly when he closes the door. The clutter and cacophony somehow seem appropriate, perhaps mimicking the plethora of ideas which rattle inside Mr. Aslanidis' head — rumbling and bumping into one another until he comes up with something useful and original, like the Recycling Eagle.

It's the product of ten years of experiments by Mr. Aslanidis and a partner, David Vosburg, an engineer at the nearby Diablo Canyon nuclear-power plant. The nuclear engineer liked to design computers as a hobby, and the recycler/inventor liked to brainstorm new ways to keep people's junk out of landfills. They got together and after many trial runs and years of working out the bugs, the pair now believe they've come up with a marketable creation.

Apparently, others agree. Mr. Aslanidis says he's had many offers to buy him out and he

gets calls from around the world from recyclers interested in his design. He recently took on some investors so he could keep the assembly line going at full speed. (Each machine costs about \$20,000 to manufacture.)

Mr. Aslanidis calls the Eagle "the poor man's ATM," used by the homeless and shoppers alike to redeem their cans and bottles.

He's proud of the fact that it's fun to use. Walk up to the tall, white machine and push

a button. A severe mechanical voice intones, "Do not shove containers. Please do not put in broken or bent containers." Feed it and a conveyor belt starts up, pulling cans, bottles, and plastic containers inside. They're identified, separated, and dropped into the appropriate receptacle. Aluminum cans are even crushed and pushed into their final resting place by a puff of air.

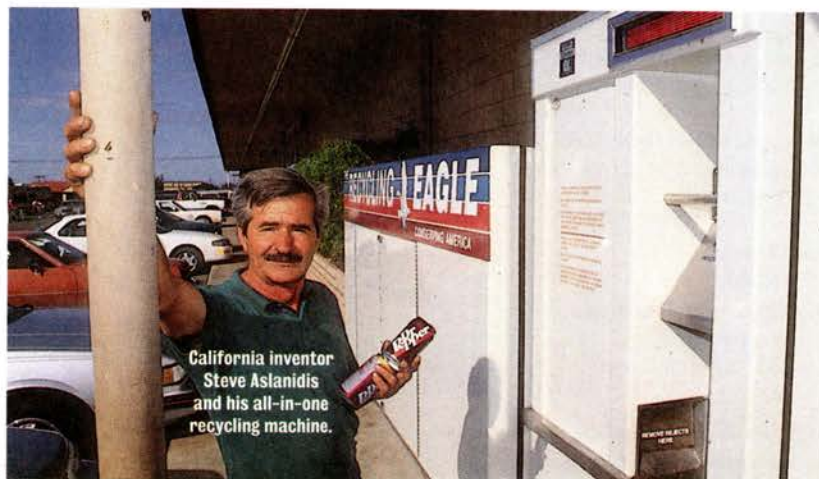
The Eagle is ever-vigilant against would-be cheats. Some folks try to fool it by tying a string to a can, letting it get pulled in far enough to record the value, and then pulling it back out. Try that with the Eagle and it will shut down, bark "Don't do that," and call Mr. Aslanidis for help.

Mr. Aslanidis hopes he's got the wave of the future in his manufacturing shop: A recycling machine that can be programmed to take whatever containers are widely redeemable in years to come, whether they're tin cans or wine bottles or who knows... maybe even Styrofoam cups!?

Earnings-potential isn't the only motivator for this 16-hour-a-day businessman. "I have a seven-year old and a ten-year old at home," he says. "I want to help make sure the landfills aren't all full by the time they grow up."

— Jan Greene

Jan Greene is a reporter at the Telegram-Tribune in San Luis Obispo, California, where she covers environmental and agricultural issues.



California inventor Steve Aslanidis and his all-in-one recycling machine.

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A Perverse Law of Garbage

ONLY TWO REFUSE REALITIES CAN REDUCE STALWART Garbage Project sorters to fear and loathing: one is raw, rancid chicken (as bad as any smell stinks); the other is Parkinson's Law of Garbage (as unintentionally perverse as any human behavior becomes). Anyone in the vicinity immediately recognizes rancid chicken; Parkinson's

Law of Garbage was exposed only after thousands of Garbage Project sorts of household refuse pick-ups.

The original Parkinson's Law was formulated in 1957 by C. Northcote Parkinson, a British bureaucrat who concluded: "Work expands so as to fill the time available for its completion." Parkinson's Law of Garbage similarly states: "Garbage expands so as to fill the receptacles available for its containment." While the evidence for this refuse law is not yet conclusive, its implications go to the heart of every city's solid waste-management strategy.

During the past decade, many municipalities have switched from a system whereby homeowners provided their own garbage cans, and sanitation workers emptied them by hand, to a system whereby the city provides special containers that trucks empty mechanically. The object is to save labor costs and to reduce worker injuries. Mechanized trucks can handle only a limited number of sizes of bins. Since large households must be accommodated, most city residents therefore receive a very large — 90-gallon, in most cases — wheeled container.

In 1980 the city of Phoenix adopted such an automated system, with 90-gallon containers, and a subsequent Garbage Project study (in 1988) revealed that the per-capita generation of garbage seemed to have become abnormally high, at least as compared to Tucson, a mere 100 miles away.

Nothing more was made of this finding until researchers began analyzing data from areas of Tucson that had recently converted to mechanized collection. We realized that garbage-generation rates of sample households had shot up about a third, comparable to the apparent increase in Phoenix.

Other cities that have mechanized are also registering significant increases. In Sacramento, for example, the annual per-capita haul has risen from about 1.4 tons before mechanization to more than 1.8 tons afterward, even as tipping fees have more

than doubled. A Dodge City, Kansas, sanitation official expressed surprise at the results of a pilot program in which households were given 120-gallon garbage bins: "People filled the suckers up!" In Beverly Hills, neighborhoods have been given 300-gallon containers, and one can only wonder what effect such encouragement will have on a community whose discard patterns are already excessive. (Beverly Hills is the kind of place, according to sanitation officials there, where some homeowners regularly pick up the sod and throw out their entire lawns twice a year, switching grass type to keep it green year 'round.)

Parkinson's Law, with respect to garbage, is quite simple. When people have small garbage cans, larger garbage — old cans of paint, broken furniture perpetually awaiting repair, bags of old clothing — do not typically get thrown away. Rather, these items sit in basements and in garages, often



until a residence changes hands.

But when homeowners are provided with plastic mini-dumpsters, they are presented with a new option. Before long what was once an instinctive "I'll just stick this in the cellar" becomes an equally instinctive "I'll bet this will fit in the dumpster."

The Garbage Project has compared the contents of Tucson garbage collected before and after mechanization. Solid-waste discards went from an average of less than 14 pounds per biweekly pick-up to an average of more than 23 pounds. The largest increase was in the yard-waste category, followed by "other" (broken odds-and-ends), food waste, newspapers, and textiles. The first pick-up of the week was substantially heavier than the second, reflecting the accomplishment of weekend chores, and the discards in that pick-up contained consistently larger amounts of hazardous waste than we had come to expect in a typical load. These findings suggest that the introduction of 90-gallon containers should be of concern for three reasons.

3 Uh-Ohs

FIRST, THE INCREASE IN DISCARDED NEWSPAPERS suggests that one counter-productive result of larger containers may be a lower participation rate in any form of recycling. For those who find separating out recyclables a bother, the 90-gallon bin is a no-penalty means to circumvent the issue. Likewise, the increase in "other" and textiles could mean an alternative to the "donation avenue," which leads unwanted resources to the Salvation Army and other charities.

Second, the substantial increase of hazardous wastes indicates that the large bins are a convenient alternative to storing toxic items until used up at home or until the next household-hazardous waste collection day.

Third, at the same time massive, all-out recycling programs are being implemented to decrease the flow of garbage, collection techniques are being installed which unwittingly may be increasing the overall flow of garbage to an even higher rate. ☞

Archaeologist Dr. William L. Rathje is founder and director of The Garbage Project, and professor of anthropology at the University of Arizona - Tucson.

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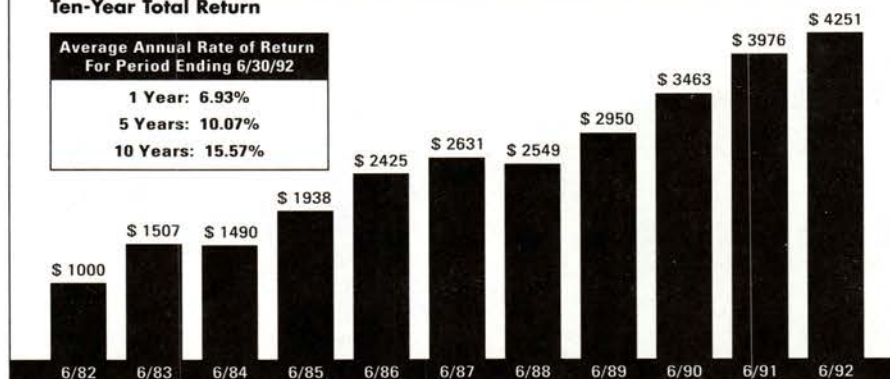
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PACKAGING

in the '90s

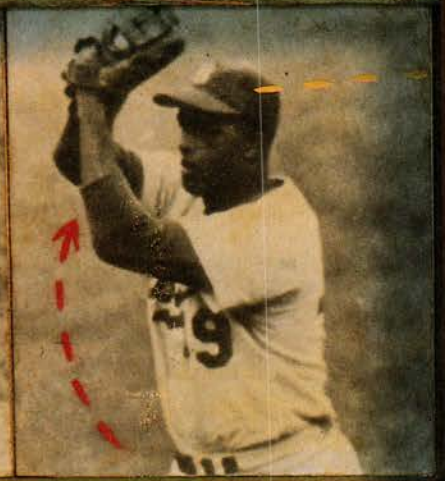
Packaging looks to the future (and to the '50s) in response to environmental concerns. Some changes are on target — and some are an image game.

The Real World



PACKAGING HAS AN IMAGE PROBLEM. IT IS CONSISTENTLY portrayed as an environmental assault: a major part of the waste stream, an unnecessary luxury in a wasteful society, an environmental problem requiring immediate action. This bashing goes on not only in the environmental magazines, but also in general “consumer” coverage in newspapers and on tv. (Mostly, of course, *plastic* packaging is targeted, based on the myth that will not die: that “natural, biodegradable” materials are always better than plastic.) Further, nefarious motivation is often ascribed to the packaging industry itself; for example, much ado is made about packaging’s ulterior use as an advertising vehicle, but you seldom read about its hygienic functions or value in efficient transportation. ¶ Other assumptions are made, too, in environmental coverage of packaging. One is that innovations promulgated by environmentalists, such as the focus on recyclability, are always sound. Another is that industry adoption of those innovations is proof that they were environmentally correct. In other words, there is little distinction made between packaging changes that do indeed have a positive environmental impact, and “image enhancers” adopted due to consumer demand, whether or not that demand is misguided. ¶ Given the attention being paid to packaging, such unquestioned assumptions may be dangerous. After all, public perception drives both marketing and regu-

Illustrations by Gary Tanhauser



lation. Public perception is occasionally misinformed, especially in a complex or newly important arena. That would mean that regulation — a political process largely based on public perception — would be misguided as well. So before we go on to describe packaging innovations, we'd better go back a few steps and examine our packaging assumptions. (Every sixth-grader knows that ASSUME makes an ASS of U & ME.)

A MAJOR PART OF THE WASTE STREAM? Discarded packaging makes up one-third of our garbage, a dubious distinction that has focused much wrath on its purveyors. But there's more to that statistic than meets the eye. The number doesn't refer to food packaging discarded at home — the very visible but relatively minor target of most proposed regulation. According to Judd Alexander, author of the forthcoming book *In Defense of Garbage*, 44 percent of packaging is shipping-related — pallets, crates, cardboard cartons, stretch-wrap, and the like. Hardly a marketing gimmick, this packaging is strictly functional — and one of those functions is to reduce breakage waste.

Conservative estimates would put consumer product packaging at about 15 percent of the waste stream. That's enough to make packaging a realistic target for environment-related innovation. The packaging industry agrees with environmentalists and most consumers that environmental concern should be added to the existing list of criteria for responsible packaging.

A WASTEFUL LUXURY?

Certainly, offensive packaging exists, and it gets the lion's share of attention. But most packaging is both necessary and efficient, the result of years of improvements. Packaging fulfills many functions, most of them with as great or greater an impact on public health as environmental concerns have. For example, packaging protects meat and dairy products from bacterial contamination. Packaging has to be efficient and cost effective in manufacture; efficiency at this stage often has a greater overall environmental impact than does efficiency at the disposal stage.

Although it uses resources and ultimately becomes part of

the waste stream, packaging can actually prevent greater waste elsewhere. An oft-cited example is the remarkably low spoilage (waste) rate of food in the U.S., which stands at less than three percent. The low spoilage percentage contributes to this country having the world's least expensive food supply. With less sophisticated packaging and distribution systems, many parts of the world still have a serious problem with food safety, supply, and spoilage.

AN ENVIRONMENTAL PROBLEM? On calm reflection, most people would agree that packaging fulfills important functions and has become more efficient with technological advances. So why the urgency to respond to packaging as an environmental crisis? Because another collective assumption is that it is growing exponentially as a percentage of the solid waste stream — that we will be buried in plastic microwave trays if we don't do something. Immediately.

Fortunately, the facts don't back the assumption. Yes, there has been an increase in per-capita generation of household garbage. That increase is often blamed on packaging. Truth is, shifting demographics are the reason, as explained on page 27. Food and beverage packaging wasn't a big part of that increased garbage

load. Despite isolated examples of bad packaging, we needn't fear that the category itself is overtaking us.

This is the place to consider the difference between a garbage problem and an environmental problem. The two are often confused, especially when it comes to high-profile garbage such as packaging. Almost all of the bad press aimed at packaging, and almost all of the legislative proposals targeted at packaging, concern disposal: how much packaging in the waste stream? is it "biodegradable"? is it recyclable, or made with recycled content to lessen the strain on landfills?

All of those are garbage questions. To gauge true environmental impact, packaging would be considered at the manufacturing (use of resources) and transportation (use of energy) stages as well. The distinction between an environmental problem and a garbage problem is an important one, because some of the legislative mandates would seek to make disposal easier at the expense of overall environmental impact. Given that garbage management, for all its complexity, is still one of the easiest environmental problems to solve, it is often a better compromise to deal with product packaging discard, than to risk increasing food waste or transportation (fuel) costs.

ENVIRONMENTAL COSTS OF PACKAGING			
ONE STUDY'S FINDINGS			
Tellus Institute's assessment of the hidden environmental costs, from air pollution to lung disease, of producing various packaging materials.			
MATERIAL	PRODUCT	COST/TON	COST/PACKAGE
PVC	CONTAINER FOR 100 NAILS/SCREWS	\$5,053	\$7.44
VIRGIN ALUMINUM	12 OZ SOFT DRINK CAN	\$1,933	\$3.72
RECYCLED ALUMINUM	12 OZ. SOFT DRINK CAN	\$313	\$.60
PET	1/2 GALLON JUICE CONTAINER	\$854	\$11.52
HDPE	1/2 GALLON JUICE CONTAINER	\$344	\$2.56
PAPERBOARD	1/2 GALLON JUICE CONTAINER	\$330	\$3.84
RECYCLED AND VIRGIN GLASS	1/2 GALLON JUICE CONTAINER	\$55 TO \$85	\$9.60 TO \$12.16

Contributing to this article were HANNAH HOLMES, who, generally speaking, believes that legislated mandates jumpstart environmental initiatives, and PATRICIA POORE, who, generally speaking, believes they get in the way.

Thanks also to Karl Kamena (Dow Plastics, COPPE), Geoffrey Lomax (National Environmental Law Center), Dr. Susan Selke (Michigan State Univ.), Dr. Frank Ackerman and John Schall (Tellus Institute), Chip Foley (CONEG), and, most especially, to Judd Alexander.

DEMOGRAPHICS & DISCARDS

Why there's more garbage, and why packaging isn't the culprit

IT'S TRUE: WE DO THROW AWAY MORE GARBAGE, COLLECTIVELY AND individually, than we did twenty years ago. (About 3 lbs. per person per day in 1970, to about 4 lbs. in 1990.) As a society, we overwhelmingly believe that this is an environmental problem, either because we don't want to build more landfills and incinerators, or because we think that our growing discards reveal an unsustainable consumption of resources. So we would like to find ways to make less garbage.

In addressing the issue of making less, we tend to focus our concern on the most visible types of garbage. Packaging gets a lot of attention because we bring it into our homes, because it turns up as litter, because it is sometimes made of plastic (which has all sorts of negative associations, right or wrong), because it is potentially recyclable (which has all sorts of positive associations, right or wrong), and because, well, it's often garish.

But, before we do something expensive, let's look at the *whole* picture: What happened in the United States between, say 1972 and 1987, that might have had an impact on our generation of garbage? And what happened with packaging over that same period?

That's just what Franklin Associates did. (Franklin is the environmental research firm that produces periodic updates on solid waste for the Environmental Protection Agency.) The firm looked at demographic shifts during that 15-year window, and came up with some surprising findings.

■ **HOUSEHOLDS** During the period, the population of the U.S. grew 16% — but total discards went up 28% (after recycling). At the same time, the number of households in the country went up 34%, twice as fast as population growth. (Reasons include delayed marriages, more divorces, and a growing elderly population.) Today, twice as many people live alone as in 1970, and that has had a tremendous impact on garbage.

Yard waste, always a big category of garbage, grew 34% during the period, a perfect corollary to the increase in number of households. (Most of this waste — leaves, grass, trimmings — still goes to the landfill or incinerator.) Major appliances (dishwashers, refrigerators, washing machines) grew 74%, or 4.5 times faster than population growth. (Think about it: Nobody's home to spend hours at the laundromat. Microwaves are in 90% of homes today, compared to nearly 0 in 1972.) Home furnishings discards grew 80%, and clothing/footwear grew 260% (these figures for the period 1970-1988). So, as a society, we are better equipped, we redecorate more often, and we change fashions faster than in 1970. That may not be environmentally sound, but it was a collective decision.

■ **EMPLOYMENT** A tremendous shift took place at work. The total workforce increased 38%, with office work growing 72% (that's 4.5 times greater than population growth). Some of that can be accounted for by the shift from a manufacturing to a service economy, but even more important was the massive entry of women. The results have been far-reaching. First, we spend less time on



cooking, cleaning, and shopping. Second, income increased. This brought about an increase in the purchase (and disposal) of time-saving products, including prepackaged food, and those appliances mentioned before. It even created a booming mail-order market with its attendant catalogues.

Printing and writing paper grew 73%, office paper 87%, and copier paper 150% during this period (supposedly the dawn of the paperless, electronic office). The shift to a service and information economy contributed still more paper. Also, total book tonnage grew 24% (50% faster than the population), magazine tonnage went up 38%, technical books grew 211%, and commercial printing (brochures, catalogues, "junk mail") increased 133%.


■ **WHAT ABOUT FOOD & BEVERAGES?** Everyone assumed that changes in our eating patterns would have had a large impact on solid waste. Surprise! not so.

It's true that Americans eat more takeout meals and have vastly increased expenditures on easy-prep meals (up 58%). But the weight of food packaging and utensils in the trash was up only 7%, or less than half the growth in the population. (In the period 1970 to 1988, total container and packaging discards, per capita, was up 8%. But packaging recovered per capita was up 197%. So the net container and packaging discards per capita actually went down

10%). Apparently, there are two reasons for this outcome: reduced packaging, and recycling.

The food industry had dramatically reduced its packaging in many categories. Almost all materials collected in curbside recycling programs, except for newspapers, come from food and beverage containers. For instance, although the volume of beer and soft drinks consumed increased 52% during the study period, the weight of beer and soft drink packaging discards went down 28%. Thinner, lightweight materials such as aluminum and plastics are used more frequently. And they are recycled more.

(As the accompanying article suggests, it is also relevant that, in the period 1970 to 1988, our GNP per capita went up 39.2%, and our expenditures on durable goods went up 41.1% — but our food expense per capita, in constant dollars, went down 3.2%. [U.S. Bureau of Census])

WHERE DOES THIS LEAVE US? CERTAINLY, IT HELPS US UNDERSTAND trade-offs: In this case, more municipal solid waste was the trade-off for working out of the home, comfort and convenience, and a shift in household size. Admittedly, greater understanding makes the issue more complex. Instead of just zooming in on, say, packaging companies and telling them to "make less," we have to delve into our feelings about what constitutes quality of life. When we have the answer, packaging (as well as the products packaged and the market itself) might have to change drastically, as part of another overall shift. Nobody's off the hook. But at least we won't be slaying dragons, only to find out we can't afford the funeral. 

Thanks to Tom Ruttray at Procter & Gamble for his analysis of the Franklin study.

Packaging can become more environmentally responsible in a number of ways: reduction in the use of raw materials, weight reduction for more energy-efficient transport, recyclability and the use of recycled stock, integration of packaging manufacture with waste management (e.g., use of less toxic materials). When the only priority is lessening the amount of discard after use, opportunities are lost.

Reinventing the Refillable

CLINK. CLINK. YOU STUMBLE TO THE DOOR, COFFEE DRIBBLING. Hmm, no one there ... Look down: on your almost-21st-century doorstep are two gleaming glass bottles of milk.

In Queens, New York, a dairy is doing a booming business delivering bottled milk. In upstate New York, in Vermont, in California, and points in between, milk in nostalgic, washable glass bottles stocks supermarkets, and health-food stores.

Why did those glass bottles of the not-so-distant past disappear? The beverage industry changed. During the 1960s and '70s, bottling plants were centralized and distribution became regional or national, rather than local. Now that bottlers were hundreds of miles from retailers, it no longer paid to haul the empties over long miles. Even in the more localized milk busi-

ness, heavy-to-haul glass got creamed by the oil embargo of '73, which made cheap transportation critical in an industry where the profit margin was already slim. Don't expect big beverage bottlers to dismantle their distribution system. It's too efficient. Refillable bottles are more likely to make sense in small systems.

Indisputably, some of the return to glass refillables is image marketing. How else to explain why, at farmers' markets in Manhattan, cityfolk snap up bottled milk at an astronomical \$1.50 a quart, plus \$1 deposit for the bottle? (Such examples illustrate the danger in mistaken environmental assumptions: There have to be better uses of money to "save the environment" than spending \$6 a gallon for milk, plus the \$4 deposit.) As long as it isn't prohibitively expensive, a dairy or local company can serve a local demographic's desire for the comforting, vaguely environmental feel of returnable glass.

What about nonglass? Some of the old problems that made refillables less efficient (or less safe) are gone. For example, new "sniffers" can detect contaminants in a returned bottle, and video technology may soon be able to spot a white straw in a white milk jug. Doug Dayhuff, an engineer for Shroeder Milk Company in St. Paul, says that even the occasional straw or toy that stays in a bottle through a washing line is pretty innocuous after being blasted with a caustic solution, 165° water, and a chlorine sanitizer.

Which is to say that refillables are not without their own environmental impact. Heating wash water transforms fossil fuels into air pollution, as does trucking containers back to a bottling plant. And managing chlorine has environmental as well as financial costs. Whether the disposable or refillable package makes the most sense may ultimately depend on local circumstances — especially the concentration of empties. "You might not want refillables in South Dakota," says Geoffrey Lomax, staff scientist at the National Environmental Law Center. "That could be counterproductive in terms of energy and solid waste."

There *are* places where refillables work:

- Shroeder Milk sells milk to grocers in sturdy gallon and half-gallon HDPE plastic jugs that have 50 to 75 lives. They're switching to Lexan plastic, which turns white if it's been contaminated. A 50¢ deposit brings back the bottles.
- Schools in New England are trading the paper milk carton for half-pint Lexan bottles with 100 lives. Even small schools expect to save thousands of dollars in landfill fees, making this an economic decision as much as an environmental one.
- Coke and Pepsi beverages come in refillable PET plastic bottles in Europe and South America, where distribution has remained local. The bottles have 20 or 30 lives.

In other instances, refillables don't make economic or environmental sense, at least not under current circumstances. In any case, it's not likely that glass refillables will return in a big way.

Another trend: bring-your-own-container programs. The following examples may be part of the overall grocery trend toward more self-service, even in supermarkets, fitting in with the salad bars, in-store bakeries, and coffee-bean dispensers. This is a boutique approach to shopping green; the system would be unwieldy, to say the least, for all your shopping needs.

- Fountain Fresh International makes a machine that refills old soda bottles in the supermarket.
- Peddlers of CitraSolv, the orange cleaner, can now buy it in 5-gallon pails fitted with a faucet to refill customers' jars.
- In the tradition of cosmetics missionary The Body Shop, both TerraNova and Kiss My Face now offer big pump jars of their potions to retailers, for refilling customers' bottles.

More Goods, Less Packaging

REFILLABLE PACKAGES AREN'T MAINSTREAM, BUT TWO OLDER TRENDS in packaging have done much more to reduce the burden. *Lightweighting* and *concentrating* are maturing gracefully. Even packaging companies that have not yet made a concerted effort toward environment-aware innovations can point to their packages that have become lighter or thinner. It's not a new initiative: Lightweighting began in the 1970s to cut transportation costs (and fuel consumption), and it continues to pay today. Now, announcing your frugality is seen as a legitimate environmental claim.

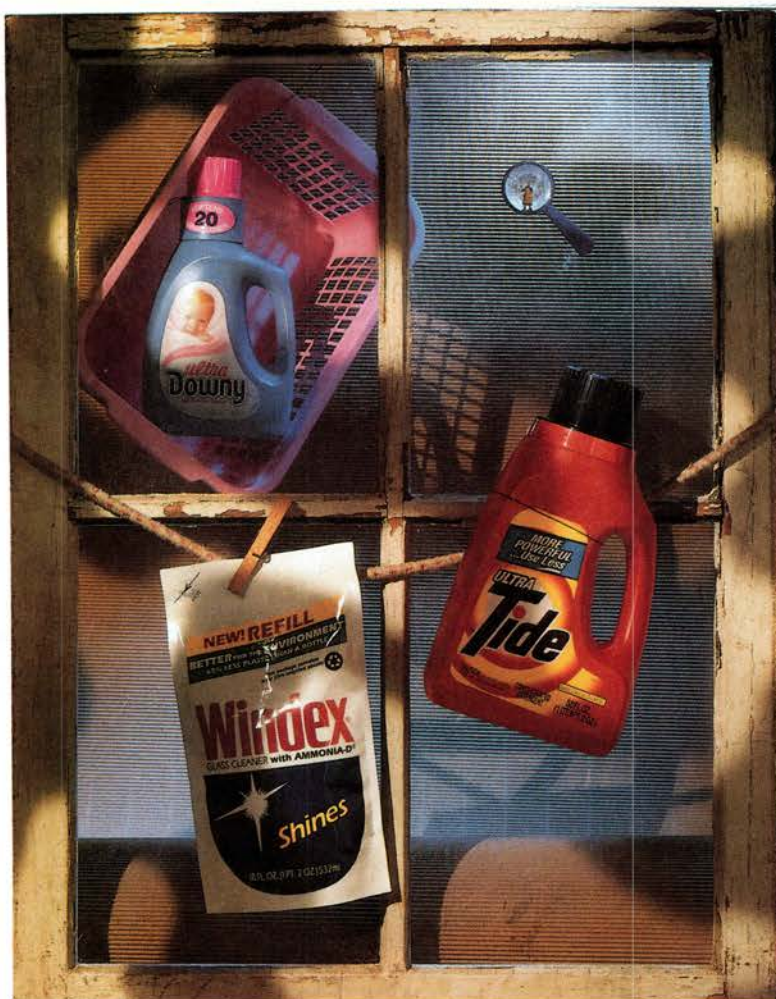
Concentrates, too, slash packaging volume and energy use in transport. But it's been harder for them to gain consumer acceptance. Faced with two similarly priced boxes of laundry detergent, one obviously smaller than the other, most people still pick the big one. "The notion that bigger is better has been so ingrained that it's a challenge to market products in a smaller package," says Procter & Gamble spokeswoman Lynn Hailey. P&G's concentrated-detergent boxes now graphically display the number of loads a box can do.

The actual reduction on each package — an ounce or two — may seem small, but it multiplies fast. First, we're talking about billions of units of consumer goods that are purchased over and over again. Second, each reduction has an impact beyond disposal: besides less garbage, it also means fewer resources extracted and processed, and less weight transported. Some examples:

- General Mills reduced the thickness of the plastic bag in its cereal boxes by 12 percent and saved 500,000 pounds of plastic a year.
- Powdered Tide, Cheer, and other Procter & Gamble laundry detergents are now marketed as concentrated "Ultras," for an 11-percent reduction in product and shipping packaging.
- P&G is also test-marketing Ultra Liquid Tide, Cheer, etc., in concentrated form. The 50-oz. bottle uses 20 percent less plastic than the 64-oz. one it replaces. Downy has been "ultra-ed," too.

Material Matters

ONE RESEARCH PROJECT DID MAKE A DISTINCTION OF SORTS BETWEEN A garbage problem and an environmental problem, playing up the front-end costs of product packaging as opposed to focussing only on disposal. According to that very controversial study, if you pop down to the hardware store and pay \$2.99 for 100 screws in a PVC-



CONCENTRATED "ULTRAS" SAVE ON PACKAGING AND TRANSPORTATION COSTS — AND ARE EASIER TO LIFT OUT OF THE CAR TRUNK. BUT CONSUMER ACCEPTANCE HAS BEEN SLOW.

plastic box, you're ringing up an additional, invisible bill for \$7.44 in environmental and health costs. If you buy the same screws in a paperboard box, your invisible bill would be only 30¢. In recycled paperboard, the bill would be just 19¢. So concludes the packaging-materials study released by the Boston-based Tellus Institute.

The "invisible bill" adds up the "externalities" of making a product — the costs that the manufacturer doesn't pay up front, some of which might be air pollution, water pollution, lung disease, and oil spills. (How Tellus assessed costs for those impacts requires a migraine-inducing explanation; it's a relatively new approach that hasn't been widely tested. Criticized for using old data, Tellus responds that it chose to use only publicly published data as opposed to confidential, inside sources that couldn't be published and replicated. Its proponents like that the Tellus impact findings are relative — sort of an "order of magnitude" comparison.)

Granted that all materials have invisible costs, what does this say about how we wrap up products? Environmentalists feel that the least damaging materials ought to be used the most. While most of the packaging materials Tellus studied rang up \$100 to \$400 a ton in health and environmental costs, PET (soda-bottle plastic) went to \$854 a ton, virgin aluminum hit \$1,933, and PVC (oil-

bottle plastic) shot past \$5,000. Of course, you can make a lot more bottles from a ton of plastic than a ton of glass, so the cost *per package* of lightweight materials is relatively lower than the cost per ton, as shown in the chart on page 26.

"We thought this was going to come out with a simple confirmation of the virtues of recycling," says Dr. Frank Ackerman, who directed the study. "But based on these parts of the lifecycle, lightweighting and concentration turn out to be very important, because they reduce the production impacts."

Furthermore, according to John Schall, who conceived the study, "The reason people ought to be recycling is not because burning or burying [discarded packaging] kills you. It doesn't. The reason is that the environmental impacts of making packages out of recycled materials are significantly smaller. Recycling should be done as part of a sound resource management system, not as a part of garbage management."

Given the current perception of packaging as a problem, the studies will go on (and on). Meanwhile, savvy marketers have already put their products into a package with a cleaner environ-

mental image. Whether it's also an environmental breakthrough won't be settled anytime soon. Never mind that perception may not equal reality; even the "science" of lifecycle analysis — which assigns a cradle-to-grave environmental impact to various materials — is imperfect. Says Dr. Selke, "These companies are probably convinced that they're making a sound environmental decision. But an unbiased observer would have to admit that's not the case." Better-material claims tend to highlight recyclability, rather than the concept of clean production, because that is what the public demands. Some examples:

- Joico, an Industry, Calif., hair-care company, puts its hair-care products in aluminum cans. Lightweight plastic is a darn sight easier to squeeze, of course, and may be more efficient and economical, but it lacks aluminum's stellar reputation for recycling.
- Likewise, Juice Bowl Blasters, a new kids' drink, is banking on a cute little aluminum can to elbow aside the aseptic juice-box. (Incidentally, the Tellus Institute study gives the juice-box high marks, as do packaging experts, who agree they are a vast improvement over heavy glass.)

- Tom's of Maine roll-on deodorant boasts a glass container, with glass refills. Tom's stick deodorant is going into HDPE plastic, which enjoys a fair recycling reputation.

The ideal package is occasionally *no* package:

- The disrobing of Sears' Craftsman screwdrivers and pliers will eliminate about 78 tons of plastic a year.
- General Electric's silicone sealants are no longer blister-packed on a paper card — a hole in the bottom of the tube allows it to hang on a nail. Several caulk and sealant makers have designed refillable caulking guns, replacing cardboard cartridges with chub packages (like sausage), reducing packaging 86%.
- Procter & Gamble saves 3.4 million lbs of paperboard a year by taking the carton off Secret and Sure deodorants.

"These packages have been used primarily to make stocking shelves easier, and for consumer appeal," says Dr. Selke. "Well, it's no longer appealing to consumers."

Initiatives & Flapdoodle

IT'S FASHIONABLE FOR ENVIRONMENTAL WRITERS TO point to Germany and Holland as "tough on packaging." Indeed, Germany's (anti-) packaging law is the most extreme: In April 1992, shoppers had to start leaving secondary packaging (the box around the toothpaste tube) at the store, in bins provided by the retailer. Retailers will pressure manufacturers to eliminate unnecessary packaging, the theory goes. By January, shoppers must return sales packaging (the actual bottle, tube, box) to the retailer.

To avoid the take-back, manufacturers have collaborated on a non-profit agency to collect their packages at the curbside instead. Member manufacturers display a green dot on their packages, which will be collected in special bins. If this effort brings in 80 percent of packaging by July 1995, the retail take-back will be cancelled. The plan has gotten bad press, partly because markets for the used packaging haven't been developed.



The Dutch have focussed on packaging as well. In June 1991, industry and government signed a binding agreement that no packaging would go to landfills by the year 2000. Manufacturers will be responsible for large reductions in the weight and toxicity of packaging, and will move toward refillable packages. Details include a ban on free supermarket bags, small toothpaste tubes, and gift-boxed liquor; beverages in non-refillable bottles can't be advertised; a refilling system will be sought for wine and liquid detergents; chlorine-bleached paper beverage cartons will be eliminated.

Any attempt to compare German or Dutch packaging plans with the U.S. is doomed to drown in complexity, especially if it's undertaken in the space of one article. For one thing, we have no idea yet how the programs will fare in the European Community (a closer approximation of the size and population of the U.S.). And things are changing moment by moment; the latest news is that German environment minister Klaus Töpfer, the author of the strict recycling legislation, visited a plastics-industry trade fair to suggest that Germany may follow France in allowing waste-to-energy incineration of plastics to be considered a form of recycling.

So let's not compare apples to oranges, or sauerkraut to apple pie. What about legislative initiatives and proposed regulation here? None of the major packaging or recycling initiatives passed in the recent national elections. But that doesn't mean the issue is dead. Big laws are waiting in the wings. The reauthorization of the nation's solid-waste law, the Resource Conservation and Recovery Act (pronounced "rickra"), has been saddled with packaging proposals, including one that would mandate the use of recycled material, set recycling goals for various materials, and encourage reusable packaging. However, RCRA is entangled, ensnared, and enmeshed in political flapdoodle. "That's because the focus on packaging and recycling is political, and has little to do with addressing the environment," offers Dow Plastics spokesman Karl Kamena.

Then there's the CONEG legislation, put forth by the eight-state Coalition of Northeastern Governors. Like the German plan, it would set goals for industry without dictating details: By 1996, a company could either reduce packaging by 15 % throughout its operation, or it could make each package fit one of the following criteria: source-reduced by 10 %, reusable or refillable five times, made from 25 % post-consumer material, or recycled at a rate of 25 %. The percentages would rise for the year 2000.

It's not universally welcomed, either by environmental watchdogs or the packaging industry. Says packaging researcher John Schall, "The percentages are ridiculously low. Nobody would have to do anything to meet the CONEG requirements." CONEG's Chip Foley concurs that some companies would already meet the 15 % reduction standard, "but a lot of others think they can't hit it."

Problem is, the legislation would have little or no effect on the vast majority of package types: metal cans, glass bottles, wooden crates and pallets, corrugated, paper and plastic bags, most paper cartons, and plastic bottles for soft drinks, milk, and cider. They meet the criteria already, and total more than 88% of all packaging discards [EPA]. It's specialty packaging, a small but important segment, that would be affected by the mandates, and not necessarily in the way environmentalists envision. Multi-material packages, such as the aseptic juice-box and packaging for household



SOME REFILLABLES MAKE SENSE (ABOVE). GLASS, ALUMINUM, & PAPERBOARD (OPPOSITE) HUMOR PUBLIC DISAFFECTION FOR PLASTIC.

chemicals and pharmaceuticals, are not easily recyclable — but in many cases they are safer, lighter (and so more fuel-efficient to transport), less expensive, and less materials-intensive than glass or metal. And these products would not fit the criteria. The (rightfully) pro-recycling public may not be fully aware that sweeping recycling mandates would mean giving up some brilliant, environmentally sound innovations in packaging.

If RCRA isn't reauthorized and CONEG's legislation isn't adopted, will packagers remain free to package as they please? They never were, of course; public acceptance has everything to do with marketing. When Dr. Allen Herschkowitz, senior scientist at the Natural Resources Defense Council, says, "Right now, you could market a diamond ring in a refrigerator box," we suspect he means that legislation wouldn't stop you. "Ultimately, it's going to be regulated," he goes on. "Sooner or later, packaging companies are going to pay."

Could be. But let's keep in mind Judd Alexander's first law of economics: There is only one source of money — consumers. ☐

IT'S A SCORCHING SUMMER AFTERNOON in the Williamsburg section of Brooklyn, New York, and you can smell the pungent odor of hot sugar wafting from the nearby Domino Sugar plant. A group of kids crowds inside a graffiti-ridden handball court in the Jose De Diego elementary school's asphalt playground. Nearby, behind a tall, chain-link fence, stands the Radiac Corporation — a squat complex of interconnected industrial buildings.

Radiac. The ominous name sounds like something out of a 1950s sci-fi movie. In fact, the firm is one of a handful of U.S. brokers of low-level radioactive waste. Viewed from the street, the place presents a low profile. Unlike the sugar plant, the material warehoused at Radiac — contaminated trash and radioactive liquids stashed in stacks of 55-gallon drums — emits no telltale odor. The only outward hint of Radiac's nuclear mission is a bland sign posted on a red door that opens onto the street. "Caution Radioactive Material," it reads.

Radiac collects its radioactive refuse from what the nuclear industry refers to as "generators" — medical and research laboratories. At least so far, Radiac remains a depot, a temporary holding

**By Dan Grossman
& Seth Shulman**

Photography by Patrick Harbron

By Dec. 31st, states must find permanent storage for low-level radioactive waste. But who can think with all the shouting?

place that ships low-level waste to any of three permanent disposal facilities currently operating in the U.S.

But at the stroke of midnight on December 31, 1992, all of that will change. The federal law governing disposal allows the existing repositories in Beatty, Nevada; Richland, Washington; and Barnwell, South Carolina; to stop accepting waste from New York and other states as early as New Years Day, 1993. Washington will close its repository to all shipments from outside the western U.S. Nevada says its site will close to all waste everywhere. And after years of insisting that its repository would also stop shipments from outside the Southeast, South Carolina has agreed to continue accepting waste after the December 31st deadline — for a few more years.

Arguing that they are tired of being the dumping ground for the nation's entire pile of low-level radioactive waste, the three states have been attempting to

Doing Their L



At the Oak Ridge, Tenn.,
nuclear reservation, a worker
inspects barrels packed with
low-level radwaste.

ow-Level Best

halt shipments for over a decade. During that time the problem of finding other permanent disposal sites has been discussed, debated, and studied. It has not been solved.

States vs. NIMBYs

THE FEDERAL LOW LEVEL RADIOACTIVE WASTE POLICY, ENACTED IN 1980, was meant to remedy the inequity of shipping all of the nation's low-level waste to three states which never agreed to serve as the nation's sole disposal facilities. The intent was to require every state to either build its own low-level repository or make an agreement, called a "compact," with other states to build regional facilities. Regulators expected the facilities to become fully operational by 1985. As of late 1992, few states have come close to even *siting* a facility, much less building one.

Consider New York. In Allegheny County, protesters chained themselves to bridges to block officials from the state's Low Level Radioactive Waste Siting Commission from scouting a potential disposal site. After a three year search which encountered stiff local resistance, the Legislature scrapped a process which came up with five possible sites. Even so, Fred Padula, an official at New York's Department of Labor, which regulates Radiac, is probably right when he says that "compared to a lot of other states, we come off looking very good." Although New York is nowhere near to building a repository, Massachusetts hasn't even begun looking for a site.

What happened? The 1980 federal law lacked the muscle needed to make states take the unpopular step of choosing and building suitable disposal facilities. So in late 1985, Congress added a series of deadlines and a schedule of penalties to force states to comply. For extra measure, Congress also included a provision requiring, after 1996, that states take legal title (read: be held liable) for all low-level waste produced within their borders. Despite the so-called inducements, most states have failed to meet their deadlines.

New York, Massachusetts, Maine, Texas, Vermont, and several others are among a growing number of states which are "unaffiliated" — unable or unwilling to join with neighbors to find a solution to the radwaste disposal dilemma. While their representatives are loathe to admit it, states like Massachusetts are playing a dangerous game of chicken, assuming that if they do nothing they may get away with shipping *their* waste to some other state's new repository ... assuming one gets built. This strategy won a minor boost when, in a case brought by New York State, the U.S. Supreme Court ruled this past June that individual states would not have to assume legal title to the low-level waste within their borders after

1996, as the federal law stipulated. The Court ruled that the *generators*, not the states, should be legally liable for the wastes.

Although the decision struck down states' liability for low-level waste, it did not diminish the legal obligation for states to find a permanent home for waste produced within their borders.

It's ironic. Environmental activists have long claimed that municipal landfills for plain old household trash are filling up, yet we've never lacked for places to dump. In the case of low-level radioactive waste, though, we really are running out of permanent disposal sites. The result? The 17,000 laboratories, hospitals, and nuclear power plants which produce low-level radioactive byproducts could become *de facto* disposal sites. Despite federal mandates, places that produce radioactive debris (or in the case of private waste brokers like Radiac, places that collect it) will have to stockpile their nuclear wastes until the disposal dilemma is resolved....

Nevertheless, it's not at all clear what kind of hazard, if any, storage sites like Radiac pose to a surrounding community. After some 80,000 scientific studies worldwide and roughly \$2 billion spent on research by the U.S. government, the effects of human exposure to low-levels of radiation are still not known with any certainty. While the scientific field remains sharply divided over the dangers of low-levels of radiation, one fact is indisputable: U.S. government regulations are based on estimates of the *potential for harm* rather than firm evidence of it.

The history of the nuclear age, however, has seen expert concern mount over ever smaller doses of radiation. Since the National Council on Radiation Protection first began recommending standards for exposure to radioactivity in 1934, it has responded to new health data by lowering its occupational level three times. Similarly, the Council's standard for the general public has been reduced by a factor of five since it was first introduced in 1956.

Disposal methods have also varied. Over the past half century, low-level wastes — the most mild radioactive residues — have been flushed down drains, dumped into the ocean, and tossed into pits. Between 1946 and 1956, the federal government dumped nearly 50,000 barrels of low-level waste near the Farallon Islands, an archipelago just off the California coast near San Francisco. In 1960, Mallinckrodt Chemical Works, located in St. Louis, disposed of an entire uranium processing plant in an abandoned quarry. These indiscriminate practices have been replaced by repositories designed to keep radionuclides from escaping into the environment. But with the imminent cutbacks by at least two of the three permanent facilities, there remains much waste requiring disposal.

In recent years, more than one million cubic feet of low-level radioactive waste has been produced annually by civilian generators — roughly enough to fill a dozen Olympic-size swimming pools every year. Considerably more of this waste will require permanent disposal in the coming decades, as the nation eventually dismantles its 110 nuclear-power plants plus the eight plants that are already closed. About 15 percent of the construction debris



A transfer facility for radioactive waste: Brooklyn's Radiac Corp.

Independently or together, DAN GROSSMAN and SETH SHULMAN's articles have appeared in Smithsonian, Discover, Rolling Stone, Nature, The Atlantic, and Technology Review. Mr. Shulman's recently published book, The Threat At Home (Beacon Press), investigates the U.S. military's environmental legacy.

"Storage rooms
can hold
radioactive waste
for longer than
you and I are on
this Earth.
You can't let
radwaste shut
down the MITs
and the
Harvards..."

—MITCHELL GALAÑEK,
an MIT radiation-protection officer



from each of these massive plants must also be treated as low-level radioactive waste (see "Dismantling Nuclear Power Plants," March/April '92). That's enough material to double the amount of low-level waste generated annually over the next 30 years.

It Is What It Isn't

SO FAR, THE U.S. HAS PRODUCED APPROXIMATELY 145 MILLION CUBIC feet of low-level waste from both commercial and military activities. If you loaded it all into a row of tractor-trailer trucks they would stretch from Philadelphia to Boston. By volume, this line of imaginary trucks makes up the lion's share of all the radioactive wastes ever generated in the U.S.—some 85 percent of the total. But they'd account for just 0.1 percent of the total *radioactivity* of all nuclear wastes.

Low-level radwaste is a lightweight when compared to the highly radioactive used fuel rods from a nuclear reactor. All

told, the radioactivity emanating from all the low-level waste ever generated in the U.S. has accounted for some 18 million curies. A single nuclear power plant has significantly more curies contained in the rods of its used reactor fuel—roughly 200,000 curies per cubic foot. By comparison, the average concentration of radioactivity in low-level waste is two million times weaker: one-tenth of a curie per cubic foot.

The U.S. government divides radioactive-waste materials into five groups: high-level, transuranic, spent fuel, uranium mill-tailings, and low-level wastes. Low-level waste is defined by what it isn't. It's not the discarded, so-called "spent" fuel rods from nuclear reactors, the most highly radioactive substances on the planet. It's not the liquid waste from salvaging plutonium from reactor fuel, which also emits a large amount of ionizing radiation, especially alpha particles (see "What is Radiation?" p. 36). It's not the transuranic by-products of nuclear-weapons production

What Is Radiation?

RADIATION IS ENERGY: PARTICLES OR RAYS WHICH MOVE through space at very high speeds. Light, heat, and radio waves all form different parts of the spectrum of radiation which makes possible life on Earth. Radiation from radioactive materials occurs when the nucleus of unstable, radioactive atoms (also known as radionuclides or radioisotopes) break down in the process of attaining a stable form. As they break down, or decay, these radionuclides give off radiation that can deposit energy in human tissue. Radiation with sufficient energy to ionize, or knock electrons from the atoms of the substances it strikes, is called *ionizing radiation* and is considered to be the most hazardous.

What are the major forms of ionizing radiation? *Alpha particles* are highly charged particles which travel over short distances and cannot penetrate skin nor even a sheet of paper, but can wreak havoc if inhaled or ingested. *Beta particles* travel longer distances than alpha particles but can still be blocked by a thin sheet of glass or plastic. *Gamma radiation* is a form of electromagnetic energy with great penetrating power, like X-rays. Gamma radiation can travel long distances and can cause radiation exposure to all portions of the body without being ingested or inhaled. The lead and cement shielding commonly associated with radioactive materials is intended to block gamma rays.

While alpha radiation, emitted by radium, uranium, and plutonium, is generally not present in most low-level radioactive waste, beta and gamma radiation are. In fact, radionuclides are often classified by the emission judged to do the most bodily harm. Cobalt-60, an isotope often generated by nuclear power plants and some radiopharmaceutical firms, is referred to as a gamma emitter because the accompanying beta radiation is biologically less damaging. All of these types of radiation are described in units called *curies* — a measure of the number of nuclear reactions, or disintegrations, occurring in a radionuclide.

The amount of energy emitted by a given quantity of any radionuclide declines, or decays, with time. The amount of time over which the radioactive potency of any substance diminishes to half of its original value is called the *half life*. Radioactive phosphorus-32, an isotope frequently used in hospitals and research laboratories, has a half life of 14 days; weapons grade uranium, on the other hand, will continue to emit alpha and gamma radiation for billions of years.

The half life of a radionuclide stays constant regardless of the amount of material involved. After 14 days, one curie of phosphorus-32 will be reduced to one-half of a curie. After another 14 days this quantity will be halved again, leaving one-quarter of a curie. Since radiation is a nuclear, not a chemical process, caused by the breakdown of the nucleus of an element, neither the radioactive potency nor the half life is altered by chemical reactions. That's why incineration of radioisotopes (a chemical process) can't make radiation go away — although it can reduce the volume of the product, making disposal simpler.

— “transuranic” because the materials are comprised of radioactive elements heavier than uranium. Nor is it the mill tailings from uranium mining. Rather, low-level radwaste is defined as all radioactive materials other than the ones already described.

Low-level waste usually consists of non-radioactive liquids and solids contaminated with small amounts of radioactive material. Some examples: To chart biological processes, biomedical researchers use radioactive material to “tag” cells and pieces of genetic information. The unused solutions and disposable laboratory equipment tainted by these experiments are also considered low-level waste. Nuclear-power plants likewise must properly dispose of filters and other equipment which become contaminated with radioactivity during routine operation.

Because it comes in so many different forms, low-level waste itself is divided into four classes, depending on the concentration and half-life, or decay period, of each radionuclide (a.k.a. “radioactive element”). Class A wastes, the least hazardous group, contain just a small concentration of radionuclides and still smaller amounts of radionuclides with long half-lives. Classes B and C contain greater concentrations of long and short-lived radionuclides. For example, tritium, with a half life of 12.26 years, is of relatively less concern than carbon 14, with its half life of 5,780 years.

If all of this sounds complicated, it is. Tracking low-level radioactive waste has resulted in a bureaucratic morass. One underlying reason for the mess is that it's difficult for most people to comprehend, much less deal with, an invisible hazard that doesn't go away. Wipe it with a rag and the rag itself becomes radioactive waste. In fact, at nuclear power plants and research labs alike, a significant portion of the volume of radwaste — mops, tools, protective clothing — is generated by trying to dispose of the stuff in the first place.

Dumps by Default

MITCHELL GALANEK, A RADIATION-PROTECTION OFFICER, OVERSEES low-level radioactive-waste treatment for over 600 laboratories at the Massachusetts Institute of Technology. Laboratory and industrial waste is by and large the least dangerous of all low-level waste and makes up the smallest segment. Organizationally, however, it's the most complex piece of the disposal picture because it's generated by so many different users in so many different applications.

Clipped discretely to Mr. Galanek's monogrammed belt are the simple tools of his trade: a pager and a radiation detection badge. Pulling out a chart, he explains that most of the radionuclides used at MIT have half-lives shorter than three months. Liquids or solids contaminated with these materials are simply stored in drums. Then, when most of the radiation has decayed, the materials are treated as ordinary waste: solids are tossed in the trash and liquids are dumped down the drain. However, longer-lived radionuclides — with half lives greater than 120 days — are a different matter.

To demonstrate, Mr. Galanek leads the way to one of MIT's two waste storage rooms. “This is as high-tech as it gets,” he says while opening a nondescript door to a stark, cement room on the top floor of the Whitehead Institute — MIT's flagship



Since the 1970s, about 77,000 barrels of low-level waste have been stored at one site at the Oak Ridge facility. Twenty years later, some barrels are rusting and emitting radioactivity.

biotechnology research center. A trash bin by the door contains a clear plastic bag, bulging with its assorted contents and tied off with a yellow twist-tie. Donning protective glasses and a pair of white cotton gloves, Mr. Galanek opens the bag and examines its contents. Petri dishes, pipettes, wadded wipe cloths and disposable laboratory "bench paper" ... the bag contains anything in a laboratory which might have come in contact with radionuclides. When a number of bags have accumulated, they are tossed into 55-gallon steel barrels and compacted with a hydraulic plunger. More waste is added, and compacted, until the drum is full. Eight full drums in a corner are ready to be picked up by waste brokers such as Radiac.

In recent years, MIT has shipped annually about 60 such barrels. The university generates, in addition, some 300 small barrels of liquid waste which are sent for disposal to a hazardous-waste incinerator; plus a few barrels of slightly radioactive animal carcasses, which are incinerated on campus.

When asked what MIT will do if it loses access to permanent repositories, Mr. Galanek seems unperturbed. He says MIT storage rooms like this one could hold the waste "for longer than you and I are on this Earth.

"We're not going to close down," he continues, a bit defensively. "You can't shut down the MITs and the Harvards and the Whitehead Institutes from doing research." Mr. Galanek's default solution — stashing the stuff in storage rooms — is increasingly being adopted by generators as the disposal method of last resort.

It's the federal government that controls the largest and most hidden slice of the low-level waste stream. The Energy Department's production of nuclear weapons (and promotion of nuclear power) has, to date, kept every kind of nuclear waste within the guarded borders of its seventeen nuclear weapons-production

reservations. Although nuclear-weapons production has tapered off almost entirely, in 1991 the Energy Department was the nation's largest producer of low-level radioactive waste.

Here at the Department of Energy's Oak Ridge (Tenn.) nuclear reservation, public relations official Steven Wyatt stands before one of the facility's numerous radioactive-waste dump sites. The landscape behind him contains a black sea of 77,000 drums filled with radioactive refuse, byproducts of processing uranium reactor fuel. The barrels are stacked tightly together, covering six acres in a small valley surrounded by hilly terrain.

In the 1970s, the Energy Department intended this site to be a permanent low-level waste repository. But the wastes — radioactive sludge which was solidified and packed into drums — have already begun to leach through rusty black barrels.

A dozen workers in yellow plastic suits and white rubber boots clamber over the barrels. Each barrel in the blighted panorama must be inspected with Geiger counters to check for radioactivity. An undetermined number of barrels, perhaps as many as several thousand, must be repacked, a job that's expected to take more than a year. Mr. Wyatt explains that the government never expected to encounter leaching wastes here — ever. Yet it's been less than a decade since the barrels were deposited at the site.

The scene is especially troubling in light of the hundreds of sites like Radiac and MIT, where solid low-level wastes are temporarily stored. Despite the specialized nature of these Energy Department wastes, the problems at Oak Ridge offer a reminder of why the federal government has always sought to avoid the "indefinite, interim" storage which is now pending in most states. The leaching wastes here highlight the very real threat that drums stored in populous areas might also rust and leak.

Mr. Wyatt appears more disappointed than alarmed by the decaying barrels. Perhaps he's jaded by the checkerboard of contaminated lands and the numerous disposal sites at Oak Ridge. Almost as an aside, he inadvertently sums up the entire low-level waste disposal mess. "It's just too bad," he mutters, "that this job wasn't done right the first time."

I'VE KNOWN MANY A WOODSTOVE. FOR most of my childhood in Maine, there was the gray-enamel Glenwood, a maternal mountain of silver curlicues and cast-iron hinges. Peggy the basset hound invariably got stuck when she plowed under the skirt to bake her brains on a winter's day.

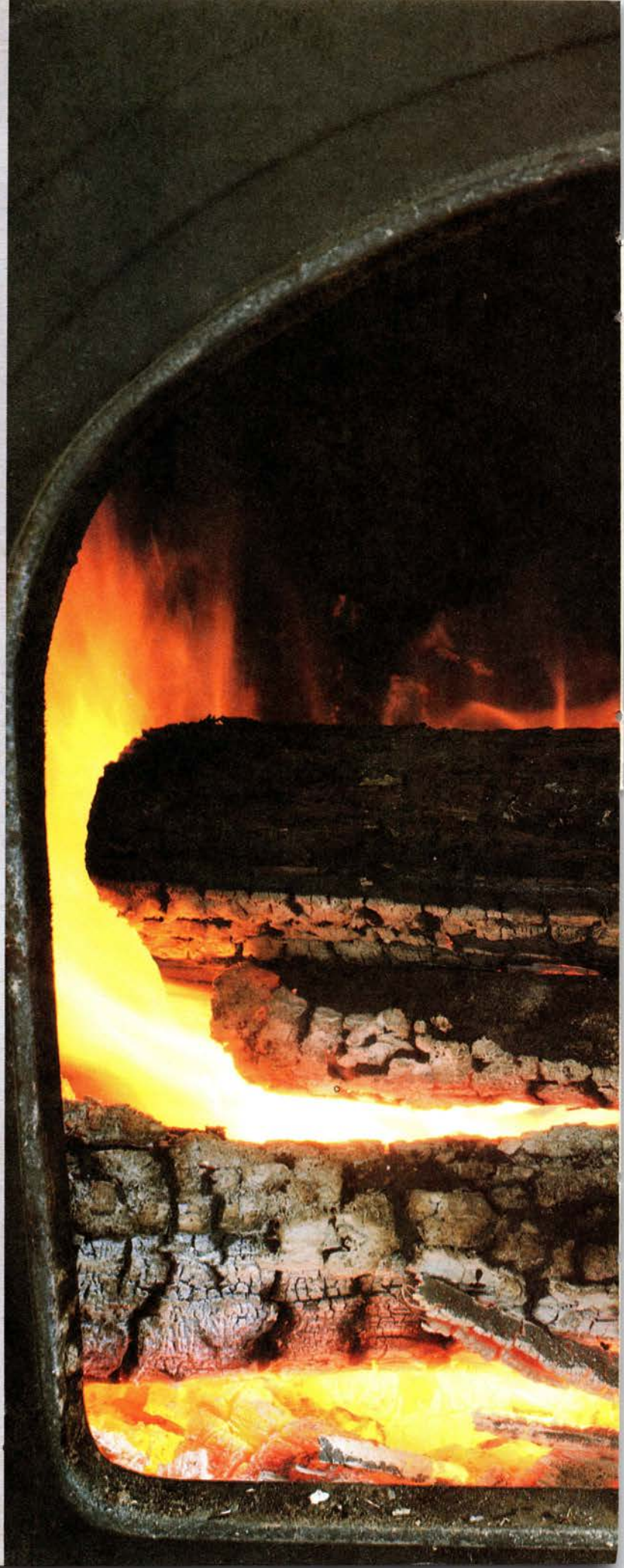
During the oil embargo, a little Jøtul airtight joined the family. We kids were warned repeatedly not to leave the draft

WOODSTOVES & FIREPLACES THAT CAN HANDLE THE CLEAN-AIR CLAMPDOWN

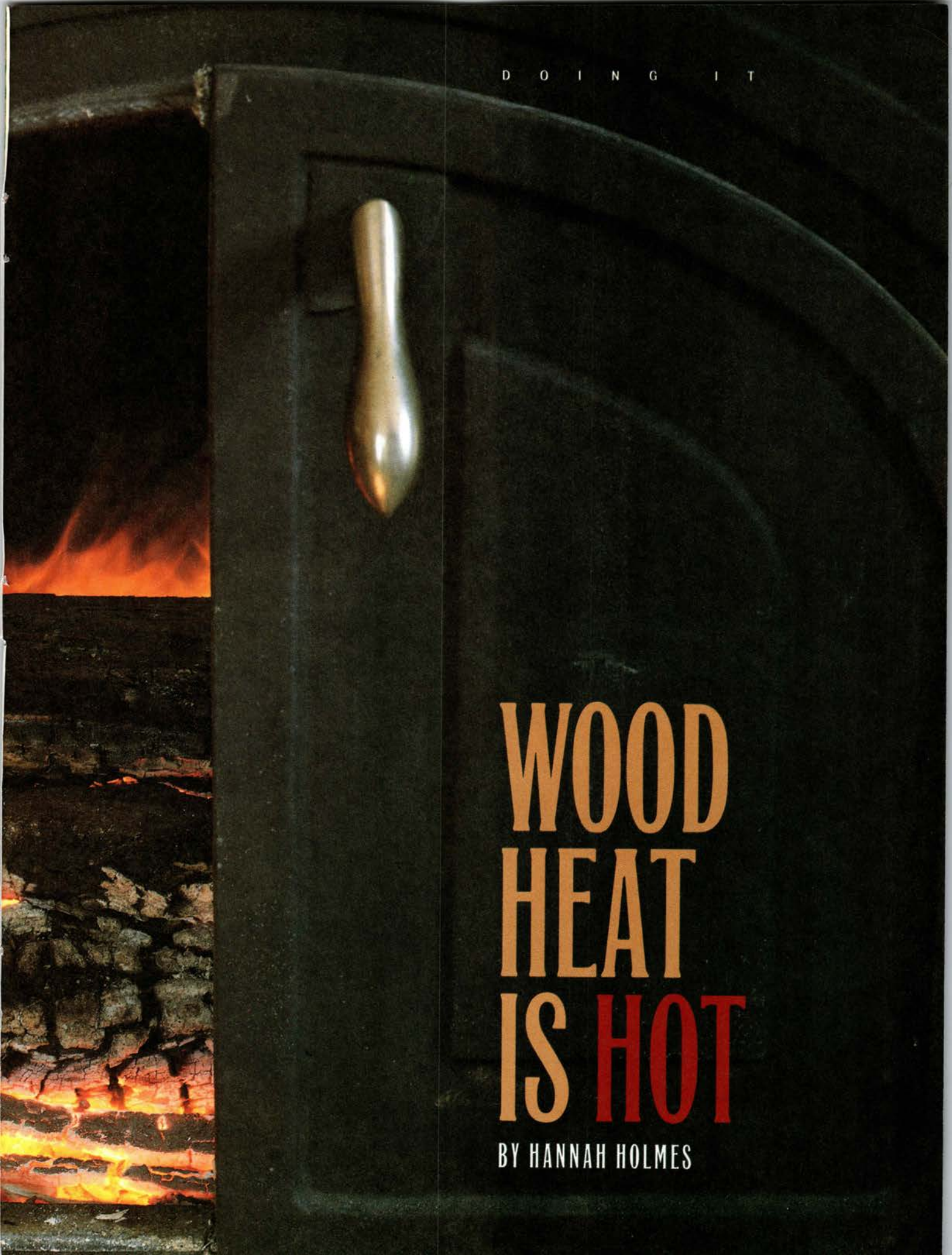
wide open, for fear of melting it off its skinny black legs. In a later house, there was a hulking airtight that looked like office-lobby sculpture; it's sidekick was truly a midget, with the dimensions of a bedside table, and a tiny oven and a firebox scaled for burning old pop-sicle sticks.

Those were the wild and wooly days of wood heat. With three demonically curious kids in the household, you can bet many, many things besides nicely aged oak and pine suffered trial by fire: junk mail, beef bones, egg shells, and cereal boxes were routinely crammed in; hair

Photography by **PAMELA E. HAWKES**



D O I N G I T



WOOD HEAT IS HOT

BY HANNAH HOLMES

clippings and plastic were especially entertaining. We even tried firing clay pottery among the gasping flames.

Try those hijinks in Denver today and you'll be busted.

Yes, the woodstove, once a symbol of back-to-nature self-sufficiency, now stands accused of causing cancer, urban smog, respiratory problems, even global warming. Wood burning is now considered one of the most polluting methods of home heating.

Last winter, Denver called 123 wood-burning bans. On a state "high-pollution day," the metro area's 320,000 woodstoves and fireplaces are cold. All of Colorado is now covered by wood-burning legislation, as are parts of California and many other states in the Rockies and Pacific Northwest.

Lounging in your condo after a hard day's skiing, gazing at a cold, black, stone fireplace, you might feel the chill fingers of personal sacrifice creeping up your spine. But it could be worse. If the American Lung Association of Colorado got its wish, you'd be forbidden to burn wood at all.

WHOLLY SMOKES!

CARBON MONOXIDE, INHALABLE PARTICULATES, HYDROCARBONS, FORMALDEHYDE — this is just a mouthful of the 100-plus compounds that waft from a chunk of burning wood.

This olfactory cocktail may smell wonderful, but beware the hangover. Carbon monoxide slows your thinking, perception, and reflexes, and accelerates the onset of angina. Hydrocarbons, particularly benzene, cause cancer. Formaldehyde is generally obnoxious, causing eye and respiratory problems as well as cancer. Nitrogen dioxide and sulfur dioxide are respiratory agitators, and polycyclic organic matter (POM) is another cancer causer.

Pre-adolescent children are especially vulnerable to this onslaught of indoor-air pollution. Studies have shown that kids from wood-burning homes have higher rates of respiratory illness than kids from fossil-fuel homes — their



Some catalytic stoves, like this model from Buck Stove, come pre-fab for fireplace installation.

BUYER'S GUIDE

STOVES NOW COME WITH AN EPA STICKER, JUST LIKE CARS. There are two numbers on the sticker:

PARTICULATES: Each stove is tested under strict conditions to see how much pollution it emits; this is stated in grams per hour. The cleanest catalytic stoves emit less than 2 grams per hour; the cleanest noncats cluster in the 3 gram range. However, as with efficiency, these ratings can go out the window when you do something to the stove that the testers didn't do — opening its door, for example, or running it cooler.

Note that EPA takes no account of a stove's size. Although Stove A delivers half the heat of Stove B, it can emit just as much pollution.

EFFICIENCY: Overall efficiency measures how much of the energy you put into the stove comes back to you as heat, as opposed to going out the chimney or lying

unburned in the ash pan. The numbers on the EPA label are virtually meaningless averages. Look instead to the manufacturer's literature, where you'll find an overall efficiency rating. Of course, running the stove any differently than the testers did screws up the efficiency.

Bob Rich at Jøtul has little patience with either rating. "Do you know how big an aspirin is? That's a gram. Everybody sees these little numbers and says, 'We gotta get this one 'cause it's a half a gram better. It clashes with my living room and my furniture, but I gotta have it.'" Likewise for efficiency, he says — how many people will notice three extra trips to the woodpile over the course of a winter? His advice:

"Does the stove have the bells and whistles that push your buttons? Chances are, it wouldn't be in the market if it weren't a good woodstove."

still-developing lungs are more vulnerable to pollutants. But elderly people, smokers, and those who already have a respiratory or heart condition are also more likely to suffer from wood smoke.

Of course, most of the smoke goes outdoors. In areas like Denver, where winter inversions trap air near the ground, wood smoke contributes to very unhealthy outdoor conditions. One study by the federal Environmental Protection Agency (EPA) concluded that inhaling wood smoke on a high-pollution day is the same as smoking 16 cigarettes.

While the toxics listed above are undesirable, particulates are a more complex problem. "Particulates" is a general term that covers little bits of almost anything — dust, carbon, ash — that floats around in the air. A particle of dust may also carry toxic chemical hitchhikers. Inhalable particulates are the worst, as they can lodge in your lungs. From there, depending on their chemical characteristics, they may make forays into the body to cause cancer or other biological mutations.

Particulates are also to blame for visibility problems. Denver, which has endowed its pollution problem with a proper name — the Brown Cloud — calculates that wood-burning is directly responsible for 22 percent of the city's visibility problem, second only to cars. Particulates represent an economic threat as well as a health threat, as Brown Clouds are pretty low on the list of tourist attractions.

As far as global warming goes, woodstoves are probably a moot point. Yes, they release to the atmosphere the globe-warming carbon that is stored in trees. But they don't release all of it, and as long as a woodlot is maintained (as it must be, if you want any wood to burn next year), a new tree will theoretically soak up the balance.

This is uniquely true of wood — those of us who burn oil or gas have no pressing reason to plant carbon sinks, nor are we able to replenish the fossil fuels we burn.

SUPERIOR STOVES

WOOD IS DIRTY BECAUSE IT'S TOUGH TO DESTROY IT COMPLETELY. The flames in your '70s-vintage airtight may look healthy, but they're probably not hot enough to burn the toxic gases that they bake out of the wood. A fair amount — perhaps 20 percent — of the energy potential in wood takes the form of gases that won't burn at less than 1100° F. So in the average stove, where the firebox only reaches temps of 800°, all the nasty compounds we met earlier simply go up the chimney. Rather than capturing the heat stored in those compounds, you and the neighbors inhale them.



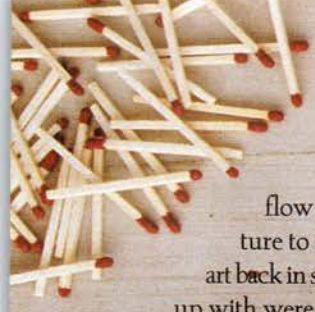
Gas stoves like those from Vermont Castings (top) and Jøtul (bottom) are the champions of clean combustion.

But as the EPA has cracked down on wood-burning appliances, technology has risen to the occasion. The new generation of cleaner stoves falls into two families: catalytic and noncat (or high-tech) stoves.

Catalytic stoves take their inspiration from Detroit. Just as the catalytic converter in your auto allows petroleum fumes to burn at a lower temperature, the catalyst in a new stove lets smoke burn at about 500°. The metal-coated catalyst stands between the firebox and the chimney. Smoke is incinerated as it passes through.

Ideally, a catalytic stove will come with a thermometer, which will help you operate it efficiently. For one thing, if the fire is too cool, smoke will clog the catalyst instead of burning. The catalyst should be bypassed until the thermometer indicates that the fire is up to speed. Second, a thermometer that struggles to reach 1000° may be the only way you can tell if your catalyst needs to be cleaned or replaced.

If you're an old hand with woodstoves, take note that a catalytic stove should be bigger than your old "low-tech" stove, and be prepared to sacrifice the responsiveness of older stoves. Thanks to the draft-deadening catalyst, it will burn more slowly and deliberately, throwing less heat.



"Noncat stoves" depend on extra air flow and insulation to raise the firebox temperature to smoke-destroying levels. Noncats put the art back in stove operation. The funky old stoves I grew up with were fun to run — a tweak of the draft and the damper could blast heat into a room in a matter of minutes. While the noncats have a much more complicated air path than the old stoves, they are almost as responsive. On the other hand, because they're designed to run hot and only hot, they require smaller loads of wood and more of them. It's generally easier to get eight hours of heat from a loaded catalytic stove than a noncat.

Which stove is cleaner? The EPA allows catalytic stoves to emit 4.1 grams per hour of particulates, and noncats 7.5 grams. However, noncats are expected to burn consistently over their lifetime, while the ability of a catalyst to burn smoke drops over the course of its lifetime. (Federal regulations require catalysts to be guaranteed for at least six years.) Catalytic stoves are also generally more efficient — they deliver more of the heat stored in wood than do noncats.

But halt the presses. Pellet stoves are a new technology that's even cleaner. Pellet stoves run on processed wood waste that looks like rabbit food. Stored in a hopper inside the stove, the pellets are fed to the firebox by an auger. Many stoves can be left alone for days. The fuel is much drier than wood, so it burns more cleanly; this means you may be able to get away with a pipe through the wall instead of a chimney to exhaust gases.

Pellet stoves are also convenient: The fuel comes in handy 40 to 60 pound bags, there's minimal ash to deal with, and certainly no wood to split and haul. In their excitement, however, some pellet-stove pushers have been slinging a little bull. Some considerations if you're intrigued by this new technology:

- Where's the closest pellet maker? Pellet makers tend to be clustered in the Northwest, and the further you are from there, the more you're going to pay for fuel.
- If you're going to depend on it for whole-house heating, you'll get chilly during power outages; pellet stoves need electricity to run fans and the feeding auger.
- Economically speaking, pellets are "marginal at best and extravagant at worst," according to Dan Melcon, a refreshingly frank member of the board of directors of the Association of Pellet Fuel Industries. Mr. Melcon, in an article written for the stove industry, calculates that pellet stoves are

RESOURCES

FOR A LIST OF EPA CERTIFIED WOODSTOVES, INCLUDING addresses, write: Wood Heater Program (EN-341 W), U.S. Environmental Protection Agency, 401 M St., SW, Washington, DC 20460; (703) 308-8688.

For these brochures, "Combustion Appliances and Indoor Air," and "Catalytic [or Non-catalytic] Woodstoves Installation, Operation and Maintenance," write: Public Information Center, U.S. EPA (PM-211B), 401 M St., SW, Washington, DC 20460.

SOME MANUFACTURERS:

Vermont Castings, Inc., Dept. GM, Prince St., Randolph, VT 05060; (802) 728-3181. Wide range of fuels.

Jøtul, Dept. GM, 400 Riverside St., Portland, ME 04104; (207) 797-5912. Wide range of fuels.

Heat-N-Glo Fireplace Products, Inc., Dept. GM, 6665 West Highway 13, Savage, MN 55378; (612) 890-8367. Gas and wood stoves.

Buck Stove Corporation, Dept. GM, Post Office Box 69, Spruce Pine, North Carolina 28777; (800) 438-2825. Wide range of fuels.

EarthStove Marketing Inc., Dept. GM, 10595 S.W. Manhasset, Tualatin, OR 97062; (503) 692-3991. Wide range of fuels.

Stoveworks, Inc., Dept. GM, One Branch St., Medford, NJ 08055; (800) STAY-WARM. Multi-fuel boilers.

twice or three times as expensive to run as wood stoves.

- Pellet stoves are not super-efficient. Although the EPA in its inscrutable wisdom has decided that they average a 78 percent transfer of stored energy to room warmth, a division of the federal Department of Energy tested four stoves and found average efficiency in the range of 54 percent. (See Buyer's Guide, p. 40.)
- Pellet stoves are self-feeding, but they're not self-cleaning. They're more complicated than woodstoves, and require more maintenance.

ELEGANT ANSWERS

WHILE GAS IS THE UNDISPUTED CHAMPION OF CLEAN COMBUSTION, the prospect of drawing a rocking chair close to the Kenmore and gazing at the blue rings leaves something to

be desired. Well, thanks to lifelike ceramic logs, fake glowing embers, and "flame picture" improvements, the new generation of gas stoves and fireplaces make gas a very appealing option, even aesthetically.

Big stove makers are getting into the gas act. "Every argument you can make for pellets, from convenience to economics, you can beat to death with gas," says Bob Rich, president of Jøtul USA, the Norwegian stove maker that studied the pellet trend, then came out with a gas stove instead.

Gas comes into your home automatically — no splitting, hauling, sweeping up, no bugs boogying out of the wood box and across the floor, no stoking the stove, no smoke, no ashes. The stove is cool enough to stand six inches from a wall, and many models can be vented through the wall, too. Though some designs use electric fans and starters, others use a push-button starter that requires no electricity. Just hit the switch for instant ambiance.

The irony with gas fireplaces and stoves is this: You'll only want one if you're hooked up to gas; and if you're hooked up to gas, you probably already have a gas furnace that's 95 percent efficient.



Pellet stoves like this model from EarthStove are fueled by wood waste.

For the sake of that pretty, yellow flame, your gas fireplace or stove will deliver a measly 60 to 75 percent efficiency.

One of the most elegant answers is an old, European solution. Masonry stoves are gargantuan installations of stone, brick, soapstone, or concrete. Many of the common designs stand

human-high or taller, and weigh a ton or two. This mass, riddled inside with smoke tunnels, soaks up the heat of a small, hot fire, then releases it slowly the rest of the day. Tom Stroud, who builds the heaters in Washington, fires his every evening for an hour and a half. When he goes to bed, the house is 72°. In the morning it's 74°, and inches down two degrees over the course of the day.

Because the fire is so hot — 2000° isn't unusual — pollution is minimal. Mr. Stroud cites lab tests on a third heater, in real-life conditions, which came in at 1.3 grams per hour, averaged over 24 hours.

That real-life heater replaced an airtight stove that burned six cords of wood a season. The masonry heater burns two to three and a half.

Alas, as with many elegant solutions, this one requires a solid foundation, both of cinder block and cash. Steve Busch, a Buckfield, Maine, mason has installed \$3,000 pre-fab units, but he also specializes in handmade, custom-designed heaters that may run to \$20,000. Such an installation becomes the very heart of a house, and may incorporate a baking oven, cooktop, water heater, wood boxes, and heated benches.

The burning question: Can wood be good? It will probably be a long time before woodstove technology can match the clean efficiency of a gas furnace. But I'll bet it will be longer before we can walk away from wood: It's not only renewable, it also renews us to shepherd an armful of the Earth's abundance across the icy path between the woodpile and the hearthside.

If you yearn to burn, you should do a number of things to reduce your inevitable impact:

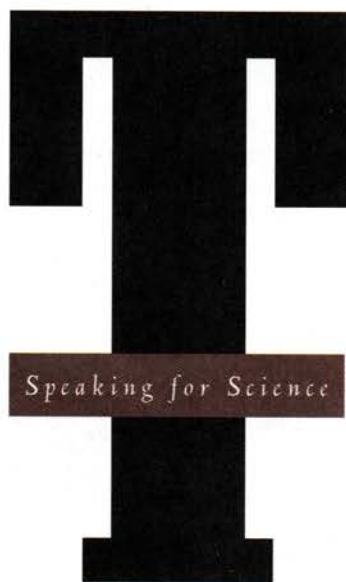
- Insulate your house so that it requires less wood to heat. Arrange your winter days around the sunny rooms.
- Burn well-seasoned, dry wood in small, hot fires.
- Regularly check your stove for cracks, crumbling gaskets, and fractured firebrick.
- Avoid burning all treated and painted woods, as they may contain heavy metals and toxic compounds.
- Use a thermometer to monitor your catalyst's performance and replace the catalyst when it cools down. Rinsing it annually in distilled water may prolong its life.
- Avoid burning all papers other than black-and-white newsprint — others are likely to contain clay coating, metals, and other additives that will not only choke your catalyst, but pollute the air as well.
- And put on a sweater!



Vesta and other masonry stoves deliver high heat, cutting pollution.

The Asbestos Mess

After a \$10 billion cleanup campaign, new research suggests that common uses of asbestos are not the public health hazard we were led to believe. Ironically, the greatest hazard probably surfaced in the rush to remove it.



Speaking for Science

he Amphibole Hypothesis. It sounds like a Robert Ludlum best-seller. But there's no spine-tingling, terrorist plot here. The Amphibole Hypothesis is a new and controversial twist in the nation's costly, contentious clash over asbestos. ¶ Here is a summary: The growing number of researchers advancing the hypothesis hold that not all types of asbestos are equally hazardous. Specifically, they say that most cases of asbestosis, lung cancer, and mesothelioma (an inoperable cancer of the lining of the chest cavity) related to asbestos were caused by high concentrations of airborne fibers, including a rare but dangerous form called amphibole, during occupational exposure. Much of that exposure occurred during World War II, under rush-production conditions: poor ventilation, poor safety practices, etc.

The researchers suggest that disease data from occupational exposures were erroneously extrapolated to potential casual exposure to chrysotile asbestos by schoolchildren and their teachers. ¶ Whether or not the Amphibole Hypothesis is upheld, it has become clear that the wholesale removal of intact asbestos created a health hazard much worse than the on-site asbestos ever did. This would mean that the \$6 to \$10 billion¹ spent on removal of asbestos from schools and public buildings was wasted.

ASBESTOS FIBERS, UNDER SOME CIRCUMSTANCES, ARE KNOWN TO cause asbestosis, an agent-specific pneumoconiosis (lung disease), as well as lung cancer, an inoperable chest-cavity cancer called malignant mesothelioma (mez'-o-thee-lee-o'-ma), and small airway passage disease. Cancers of the gastrointestinal tract, larynx, and kidney have more rarely been linked to asbestos.

There is no doubt that concentrated and prolonged exposure to asbestos causes disease. But research conducted since the initial panic has not found a preponderance of cases in workers with low airborne exposures, including such occupations as custodians, school teachers, automotive brake mechanics, and even building tradesmen who worked on construction sites right alongside asbestos workers.

This suggests that asbestos exhibits a dose-response relationship to disease and that a safe threshold may exist — particu-

larly in the absence of cigarette smoking. Research shows, definitively, that cigarette smoking is an important factor in the causation of asbestos-related lung cancer. Dr. Irving Selikoff showed that asbestos exposure alone increased the cancer rate by a factor of only about three, while smoking plus asbestos exposure increased the lung-cancer rate by a factor of 50 to 90. (Responding to an undeniable emergency, the late Dr. Selikoff of Mt. Sinai Medical Center in New York was moved to crusade against asbestos exposure as a result of his treatment of shipyard workers in the 1960s. He was among the first to become aware of the decades-long latency between exposure and disease: His patients had been exposed to asbestos in the 1940s.)

By Tom Harris
Photography by Ken Shung



Why would different types of asbestos affect the lungs differently? According to Amphibole Hypothesis researchers, the size, shape, and solubility of different mineral types interact to make the microscopic asbestos fibers more (or less) likely to reach and remain deep in the lungs. Their research postulates that the type of asbestos in widest use — *chrysotile* or white asbestos, constituting some 90 to 95 percent of historic U.S. use — is also the least dangerous. Conversely, say these researchers, the least-used form of asbestos — *amphibole* asbestos from South Africa — is the most potent, causing virtually all mesothelioma and most asbestos-related lung cancer. Of course, as a lung-irritant dust, any type of asbestos is dangerous in high enough concentrations — just as coal dust or even baking flour is.

Despite the lack of clinical proof that chrysotile is a widespread health threat, there is no clear consensus among scientists. No one really knows how many fibers are needed to initiate any of the respiratory diseases and other cancers attributed to asbestos. Experts are not sure whether it takes just one acute assault on a cell's DNA, or a chronic accumulation of fibers. Nor are they certain which effect ultimately flips on the body's cancer switch: the physical irritation of long-lived fibers, the reactive cell chemistry believed to play a role in inducing cancer, or the role of fibers as co-carcinogens (acting in tandem with more potent carcinogens such as tobacco smoke).

What is known is that shipyard workers, asbestos insulators, and others who made up the worker populations suffering high rates of asbestosis, lung cancers, and mesothelioma were exposed to very high doses of airborne asbestos fibers for long periods of time.

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Early Evidence

ASBESTOS CAME INTO MASSIVE AND USUALLY CARELESS USE IN THE great shipyards during the frantic days of World War II, and in the busy construction sites and factories of the booming post-war years. By 1971, five million tons of asbestos were processed annually for use in products ranging from decorative floor tiles, acoustical ceiling coatings, gas masks, and textiles to brake shoes, clutch plates, insulation, and roofing felt.

Numerous studies have since discovered that some asbestos industries knew of the health risks posed to workers as early as the mid-1930s. (Lung diseases were strongly suspected among asbestos workers as early as 1935.) Whether through ignorance, arrogance, or deception, the dangers were suppressed or ignored until occupational clinicians began seeing a floodtide of stricken workers in the 1960s. Lung-cancer rates, especially among asbestos workers who smoked, were staggering. But they had taken 20 to 30 years to develop and to be diagnosed.

Mesothelioma, especially in the pleural cavity around the lungs, was virtually unheard of in America until reported cases began skyrocketing in the early 1980s, the delayed result of a 30-

TOM HARRIS recently retired from 23 years of writing on environmental topics for the San Jose Mercury News and the Sacramento Bee California newspapers. He is the author of *Death in the Marsh* (Island Press, 1991), an account of selenium poisoning in the Western wildlife refuges.

Types of Asbestos

Chrysotile (kris'-o-tile). Also called "white asbestos." Soft mineral with long, hollow fibers, mined from serpentine rock. Chemically and physically different from those of the amphibole group. Source: Canada. Primary uses: asbestos-cement, fireproof insulation board, fireproof textiles, flooring, electrical components, automobile brake linings. Peak usage 1940s, '50s, '60s. Continued use today where there is no satisfactory substitute. Accounts for 90 to 95% of total historic use of asbestos in the U.S.

Amphibole (am'-fi-bol). Group of silicate minerals with small, hard, solid fibers, mined from metamorphic rock. Source: South Africa. Primary use: underground asbestos-cement pipes, battery boxes, packing & gaskets for pumps and valves, gas-mask canisters. Peak usage during and just after W.W. II. Accounts for 5% (some estimates to 10%) of historic use of asbestos in the U.S., much of it in military and industrial applications. **Crocidolite** (kro-sid'-ol-ite). A lavender-blue or greenish mineral of the amphibole group. **Amosite**. A brownish geologic cousin of crocidolite, less commonly used and less studied.

to 40-year latency period. Some researchers contend that a sharp upward turn in the number of mesothelioma cases is still possible, since peak exposures to its cause occurred during the 1940s, '50s, and '60s. In fact, one report found a 50-percent increase in the disease from 1980-'84 compared to 1975-'79.

Even so, a number of researchers report that mesothelioma cases have leveled off and that chrysotile is a weak initiator of this inoperable disease. Disturbingly, contradictory conclusions were drawn by a Japanese study, in their report to a recent conference of the respected International Agency for Research in Cancer (IARC). That study of 19 mesothelioma cases found that amphibole fibers were indeed present in 13 cases — but that *chrysotile* fibers alone were found in the other six cases.

Controversy over numbers is a hallmark of the asbestos debate.

Regulators (Over)React

WE NOW KNOW THAT THE HEALTH-RISK ESTIMATES OF THE 1970S WERE exaggerated, and in hindsight it becomes apparent that the Congress and the EPA overreacted. At one point, then-Secretary of Health, Education and Welfare Joseph Califano Jr. predicted an ultimate asbestos-related cancer-death toll of two million people! The revised figure is but a shadow of its former self: no more than 5,000 to 10,000 asbestos-related cancer deaths annually.

Scientists, too, miscued. The National Cancer Institute, the National Institute of Environmental Health Sciences, and the National Institute of Occupational Safety and Health all accepted unchal-

¹The cited estimate of \$6 to \$10 billion is based on counts done by everyone from the asbestos industry to the National School Boards Assn. But the dollar figures are compiled from state and local figures; no comprehensive audit has been conducted at the national level.

lenged the occupational risk numbers reported by Mt. Sinai's Dr. Selikoff. Most erroneously, they also assumed that public risks would follow similar dose-response lines, and that public risks would accelerate with any exposure to asbestos. The compounding errors led to their predictions of annual asbestos-related cancer deaths of 58,000 to 75,000. Thankfully, nothing like that ever occurred. By 1981, cancer epidemiologists had slashed those numbers by nearly a factor of ten.

In the Oct/Nov '92 issue, GARBAGE readers got a crash course from noted toxicologist Dr. Alice Ottoboni in the principle of "the dose makes the poison." Simply stated, almost anything can be toxic if the dose is strong enough. On the *descending* side of the exposure scale, however, many scientists feel there is a limit beyond which no harmful effect is likely.

But the negligible effect of low-dose exposure was not the assumption in the early health-threat projections. Instead, a linear dose-response model assigned measurable harmful effect right down to the lowest observable exposure — the so-called "no safe threshold." This translates into "the only safe fiber is no fiber" theory. Many in the medical community still espouse it.

Little wonder that the ensuing panic propelled virtually all levels of government into a removal program at thousands of public school buildings. However well intentioned, the intemperate response exposed unlicensed and untrained workers to fiber threats far greater than any that future students, teachers, and even custodians would have faced, had the asbestos merely been left in place and carefully managed. (Indeed, there is a higher concentration of airborne asbestos fibers after a cleanup, no matter how careful and successful, than there was before. The contamination goes on for years.) That is the real-world conclusion of the Amphibole Hypothesis authors.

The Cleanup Hazard

THIS LEAVES THE AMERICAN PUBLIC WITH THE FORMIDABLE and discomfoting knowledge that the billions of dollars already spent on asbestos-removal efforts in schools and public buildings may have been unwarranted. The cleanup industry has made little distinction between chrysotile fibers and the uncommon but apparently far more hazardous amphibole.

Potentially tens of billions of dollars more were about to be spent on a similar program to remove asbestos from public buildings. (Dollar estimates for cost of removal from public buildings don't take into account the private money spent by homeowners and building owners to remove asbestos, sometimes to satisfy mortgage or insurance companies.) In addition, in 1989 the EPA pushed through a near-total ban on asbestos (with products to be phased out 1993-1997).

Recently, however, an independent panel of health experts and research scientists sharply downgraded the risk posed to occupants of schools and public buildings. With that report, the country's mission to search out and remove virtually all build-

ing asbestos is being detoured toward a more conservative approach of managing it in place, with removal only a last, careful resort.

A federal appeals court in Oct. 1991 overturned the sweeping ban, proposing that only new uses of asbestos introduced after 1989 be removed from sale, which should affect only 10 to 15% of asbestos products.

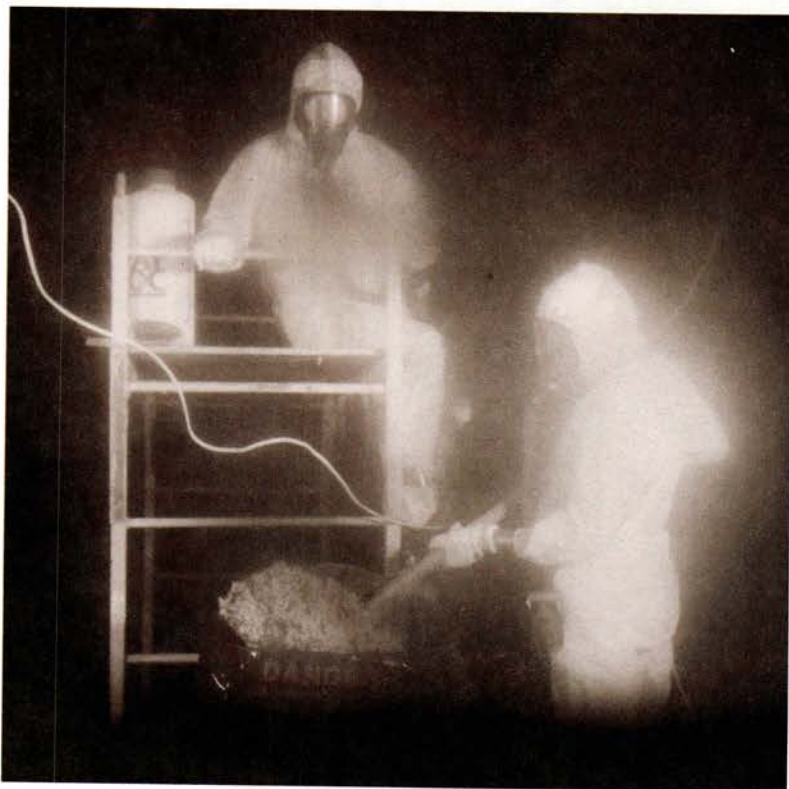
Continuing Controversy

NOT EVERYONE THINKS THE DOWNGRADE IS A GOOD THING. CRITICS of the Amphibole Hypothesis are clearly uncomfortable, even with the new research findings.

"This new hypothesis subtly presents the view of the asbestos industry," charges Dr. Orn Elliason, a pulmonary clinician who says he has examined about 2,000 asbestos patients in his northeast Baltimore clinic, not far from the large shipyards where workers were exposed to asbestos during World War II. "There is about the same difference between chrysotile and amphibole as there is between Coke and Pepsi . . .".

Dr. Corbett McDonald, a former researcher at the McGill University School of Medicine in Montreal, counters that the Amphibole Hypothesis is neither new nor flawed. He has stressed chrysotile's comparative weakness as a cancer-inducer for nearly 15 years. "It has become clear that crocidolite [an amphibole fiber] has been the major cause of mesothelioma, and that chrysotile hasn't," he says. "Our message was just overwhelmed."

Years of findings by Dr. McDonald and many others were



The tabloid press adds to public confusion with illogical headlines such as "Experts Say Asbestos Is Safe."

drowned in a steady stream of startling and well-publicized studies of the occupational hazard — asbestos-worker deaths — by Dr. Selikoff. And, for a time, many in the medical- and scientific-research community discounted the McGill work because of the appearance of a conflict of interest. Substantial funding for the McGill research came from Canada's asbestos mining and milling industry, the world's largest; other funding came from provincial and national governments with too high a stake in the balance of payments from massive asbestos exports to be considered neutral.

But three years ago, the McGill work gained belated credibility and acceptance when the prestigious *New England Journal of Medicine* published a paper by U.S. researchers who came to essentially the same conclusions. Authors Brooke Mossman, a pathologist at the University of Vermont's College of Medicine in Burlington, and Bernard Gee, a pulmonologist at Yale University School of Medicine in New Haven, Conn., warned that the public risk from casual exposure to asbestos, especially chrysotile, had been grossly overstated. The controversial crash program to remove all kinds of asbestos from schools nationwide, they wrote, *was as medically unwise as it was economically unwarranted.*

From the Editor

THE ASBESTOS STORY IS OF FULL OF IMPORTANT LESSONS FOR environmentalists, legislators, and anyone with an interest in how public perception is formed. The first wave of news stories convinced our national guardians of health that asbestos was a time bomb. Homeowners lost sleep thinking about an asbestos-wrapped pipe in the basement. Now, with the realization that the massive removal program was largely unwarranted (and dangerous), the story has again been oversimplified to make it easy to tell. Recent news stories would have us believe that asbestos is cotton-candy safe.

The true story is more complex. Asbestos — a naturally occurring mineral used for its fire retardancy at least since the days of the Roman Empire — is a genuinely useful material for which there is no perfect substitute. Its use has saved lives. Ignorance and poor handling methods led to an epidemic of fatal disease, starting in the 1960s and following a latency period after exposure in the 1940s. In a rush to respond, assumptions were made and linear models followed that would prove erroneous. A "cleanup" effort consisting of wholesale removal of asbestos-containing material — even if in good repair — subjected another generation of workers to hazardous occupational exposure. Just as the deleterious health effects of chrysotile asbestos are being questioned, it is being phased out to be replaced by less effective substitutes, which will have a public-health impact of its own.

The jury is still out on whether low-level exposure is safe, but the time has come for a reassessment of rash action.

The asbestos mess can teach us a lot, if we look for the lessons of science instead of conspiracies, bad guys, and black-and-white stories. It can teach us that environmental action is subject to continual reassessment and changes in plan, as research and epidemiological evidence mount. Hindsight is always 20/20; what would we do differently next time? — Patricia Poore

Their position has been echoed in recent national and international conferences and articles in scientific and medical journals. Not surprisingly, the reassessment is often over-simplified by print and broadcast news media, especially sound bite-conscious TV news anchors. Even the tabloid press has taken notice, adding to public confusion and skepticism with illogical headlines such as "... Experts Discover ... Asbestos is Safe."

Obviously, it's not "safe."

Clinicians vs. Researchers

THE MOSSMAN-GEE PAPER RUBBED A NERVE AMONG MANY OCCUPATIONAL and environmental health teachers and clinicians. A flurry of "letters to the editor" in technical journals called its review of asbestos literature too selective and its conclusions flawed.

Perhaps the sharpest criticism appeared in the *Journal* 18 months after the Mossman-Gee article was published there. Unanimously endorsed by all 29 member clinics of the Association of Occupational and Environmental Clinics, the letter charged that Mossman and Gee had articulated positions more legal than medical. The clinicians complained that "much of the evidence at odds with [the authors] own position" had been "emasculated" by them.

In an interview, Dr. Mossman pointed out that virtually all of the research reported at recent conferences backs their findings. She is more interested in the effect such research has had on the EPA. The September 1991 report by the 17-member scientific panel that advises the EPA on asbestos research — the Health Effects Institute-Asbestos Research (HEI-AR) — concludes that asbestos removal is unwarranted in schools where the material is in good repair. According to the study, fiber levels in those buildings are no higher than in the air outside them. Furthermore, the study's lifetime cancer-risk calculation predicts that such "good-repair sites" add no more than six cases of cancer to every one million students.

Ah, the thorny tangle of risk assessment. The public could well argue that six more cancer cases are six too many. (For comparison, note that 1,200 of every one million people die each year from long-term smoking.) But there is no question that \$10 billion would have been better spent on anti-smoking education or even school lunches. Also, the number is a controversial, possibly flawed projection: a guess, not a "real" number.

.....

Too Early for Conclusions

BOTH THE SCIENTIFIC AND MEDICAL COMMUNITIES WIDELY ENDORSE the HEI-AR's general conclusion that undamaged asbestos is much better left alone. But science sometimes serves ambiguity in place of certainty, and the HEI-AR's language acknowledges a number of constraints and omissions.

One missing piece of the asbestos-risk puzzle, the report concedes, is good documentation on exposure risks to school custodians who work around asbestos and are considered by some to be at higher risk. (There is to date no evidence of asbestos-induced disease in this group.)

Another limitation: Were the 1,377 air samples from 198 buildings used in the HEI-AR study a fair representation of all the country's asbestos-containing structures? The report cautions that its own

data doesn't necessarily reflect the daily ebb and flow of activity, which could stir up and suspend tiny asbestos particles. The study's panelists also are concerned about uncertainty over different analytical techniques used to count, measure, and identify asbestos fibers.²

The last caveat is of most interest to supporters of the Amphibole Hypothesis. Although the report's assessment is that chrysotile appears less hazardous than amphibole, its language is carefully qualified, cautioning that chrysotile's "apparent" inability to cause mesothelioma and (to a lesser extent) lung cancer comes solely from studies comparing chrysotile miners and amphibole textile workers. (The textile workers had a higher incidence of disease, but was it the *type of fiber* that was to blame? Or were the conditions in the textile mills more conducive to heavy exposure: poor ventilation and more contact with the fibers in various stages of processing?) Indeed, the study does not find any statistical differences in the ability of chrysotile or amphibole to induce lung cancer.

Although the report qualifies its findings, Dr. Mossman views the panel's work as supportive of her attack on the troubled asbestos-removal program. "My views are stronger than ever now that the HEI-AR report has essentially confirmed them," she says. "The EPA backed off on its school-cleanup program a week after the report came out."

Another Epidemic?

REGRETTABLY, THE IMPRUDENT START ON REMOVAL MAY CAUSE ANOTHER epidemic among untrained and underprotected cleanup workers. Both clinicians (who take a more conservative, anti-asbestos stand) and researchers (who tend to support Mossman-Gee) agree that we face another spike in asbestos-related disease some 15 to 40 years from now, although no one has been able to predict the number of new victims. Why not? Because air monitoring at the cleanup sites

² Counting the fibers proved to be a controversy in itself. Historically, airborne exposures were analyzed using light microscopy ("regular" microscopes). By this method, the level considered safe has dropped from about 7 fibers per ml (in 1920) to 0.2 fibers per ml of air presently. Most (if not all) of the information on exposure levels leading to damage is based on this method (visible light microscopy, 44x phase contrast).

But the EPA and many recent researchers have begun using electron microscopy, which sees 10 to 100 times more fibers in the same sample. The number of fibers is not comparable between different methods, and only *relative* using one method or the other. So far, no correlation has been attempted between the two methods, and no studies have been done to show the relationship between exposure levels as detected by electron microscope and disease levels in humans.

The problem is that people quote air contamination levels without giving the method of analysis used. The public, in turn, sees big numbers that look like awful contamination, but the numbers came from samples analyzed on an electron microscope. This tends to scare and confuse not only the public but also health officials and legislators, who may compare those big numbers to light microscope readings known to have caused disease. (Remember, the electron microscope sees 10 to 100 times as many fibers in the same sample.)

The electron microscope will detect fibers in essentially *any* air sample, no matter how pristine the source. Thus, parents of kids are kept in a state of fear because fibers can always be found in any school if this method is used. The EPA now suggests the use of the old (standard) method for school air sampling. Of course, this does not inhibit researchers with electron microscopes.

Other unknowns persist in the tricky sampling methodologies, including incomplete knowledge of whether the number of fibers counted in a (necessarily) minute sample is representative of the number of fibers in a larger volume of air. — Dr. Fred Ottoboni



A worker from EWT Contracting, Inc., a New York City-based asbestos abatement firm, at a work site in Manhattan. October 1992.

was done poorly, if at all.

Ultimately, all asbestos will degrade and crumble. Most medical researchers and physicians continue to believe that exposure to any amount, even of chrysotile, is unsafe. But they are not yet able to say just how unsafe. Scientists have been unable to link casual exposure to low concentrations of asbestos forms with cancer. At least, they cannot do so with the kind of precision that risk managers need to fairly gauge whether the health risks warrant additional cleanup. That is the next and most challenging wave of the asbestos storm: to go beyond the hypothetical and devise a medical standard for the health risk posed by low-level exposure.

For More Information

To obtain a copy of the HEI-AR report "Asbestos in Public and Commercial Buildings" send \$35 to HEI-AR, 141 Portland Street, Suite 7100, Cambridge, MA 02139; (617) 225-0866. Free Executive Summary from same address.

"Asbestos-Related Disease," *New England Journal of Medicine*, Vol. 320, No. 26, June 29, 1989; pp. 1722-30.

Safe Building Alliance, 655 15th Street, N.W., Suite 1200, Washington, DC 20005; (202) 879-5120. This is the asbestos industry education and lobbying group.

The EPA runs two different asbestos hotlines:

The Toxic Substances Control Act Assistance Service, TS799, 401 M Street, S.W., Washington, DC 20460; (202) 554-1404.

The Asbestos Ombudsman, (800) 368-5888.



Deflowering Suburbia

PERCEPTION DEPENDS ON WHERE YOU SIT IN THE FOOD CHAIN. We look at white-tailed deer and think of Bambi. After tracking the damage inflicted by *Odocoileus virginianus* on endangered plant species, some botanists look at deer and think of Jaws. ¶ "If you attempted to do [to endangered plants] with a bulldozer what the deer are doing by grazing, you'd be

hauled into court," says Susan Bratton, associate professor of environmental ethics at the University of North Texas. She co-authored a paper published in *Natural Areas Journal* (April 1992) which shows that populations of 98 species of threatened or endangered plants, scattered across the East Coast and the Upper Midwest, have been harmed by the ubiquitous deer.

Sites most vulnerable to browsing whitetails are the patchwork of forests and fields fragmented by suburbanization. Ranging now along the edges of woodlots and housing tracts, the animals seek out succulent forbs such as wild lilies and orchids. Sometimes they nibble off all the fleshy leaves and skip the flowers — botanists call it "designer grazing."

In places such as Cumberland Island, Georgia, overgrazing by deer has led to a complete change in the forest understory, creating drier regions and reducing the diversity of plant species. If the forest canopy is threatened, it might encourage succession from a live oak to a pine forest, resulting in the loss of most forest-floor plant species. "We don't know if this is happening," says Dr. Bratton, "but we're studying the possibility since Cumberland Island's live oak reproduction is so suppressed."

The deer didn't start this, of course. It's human activity — logging and black-topping — that destroys habitat and

depletes rare plant populations. Deer simply complete the job. Before we undertake the complex business of trying to restore endangered-plant habitat that's been damaged by deer, it makes sense to try and better understand the processes which cause species to vanish.

So why do whitetails seem to be doing more damage now?

By the turn of this century, relentless hunting combined with unprecedented clearcutting of forests for logging and farming had depleted large numbers of whitetails. But hunting restrictions, some reforestation of cleared land, and some abandonment of agricultural land have led to a dramatic increase in deer populations, which are probably as high as they've been in the past 100 or even 200 years. Even suburbanization may favor deer, because it removes predators and the deer seem to prefer the forest edge to the deep forest.

"Hunters want a lot of deer, and



most animal-rights folks are opposed to hunting, so both lobbies end up supporting high deer populations," says Dr. Bratton. "But no one is lobbying for endangered plants."

In some (rare) instances, the answer has been to shoot Bambi. Wildlife managers call it "culling the herd": On public lands, trackers plant bait to lure deer into small areas, where professional marksmen made short work of the problem. It's more humane than sport hunting, where recreational hunters cripple deer (and sometimes endanger the public, or at least themselves). But the pros are equally unpopular with amateur hunters and animal-rights advocates. The solution?

Scientists are attempting to put Bambi's mother on the Pill.

Jay Kirkpatrick, senior staff scientist at the Deaconess Institute in Billings, Montana, and two other scientists have developed an experimental contraceptive that causes the animal's immune system to bring about infertility. Once she's vaccinated with a protein-based contraceptive derived from pig ova, a doe's immune system recognizes her own egg as a foreign body to be attacked and destroyed, before it can be fertilized.

The contraceptive has been tested successfully on the feral ponies that roam Maryland's Assateague Island, where researchers use a dart gun. But inoculation must be followed up with booster shots. While it's difficult to hit Assateague ponies, it's even tougher to repeatedly get within shooting distance (30 to 50 yards) of a deer.

Some favor prevention over the cure. That includes the more holistic approach of educating suburbanites about endangered plant species. "People don't realize that they've got these rare plants growing right beyond their backyard," says Susan Bratton. She warns, "If a species is grazed out, eventually it won't reestablish because we've lost the local gene pool. It's gone forever."

To obtain a copy of the April 1992 issue of *Natural Areas Journal*, send \$5 for postage and handling to Reprints, Natural Areas Association, 320 South Third St., Rockford, Ill., 61104.



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Keepers

Sundial Watch

LUDDITE, n: A MEMBER OF an organized band of English mechanics and their friends who set themselves to destroy manufacturing machinery (Oxford English Dictionary). The term, named after Ned Lud, an 18th-century Englishman "of weak intellect," is now used derogatively to describe environmentalists who doubt the ability of technology to bail us out of our crises. Some modern-day Luddites have, indeed, been known to express their skepticism by maiming bulldozers and other instruments of progress.

For the Luddite on your list, consider the wrist-mounted sundial. No mercury-

fouled battery, no dehumanizing gears, in fact, no moving parts whatsoever. As long as Lud's outdoors, it's sunny, and he's carrying a compass, he should be able to tell roughly which half of the day it is.

Product #90-350, \$19 plus postage: \$3.75 Rockies and West; \$4.75 East of Rockies. Real Goods, 966 Mazzoni St., Dept. GM, Ukiah, CA 95482; (800) 762-7325.

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MAPelopes

I THOUGHT I'D WRITTEN ON every sort of garbage there is, but stationery and envelopes made from government-surplus topographical maps opened up a whole new dimension. The Forestsaver company rescued hundreds of tons of maps, and converted them to writing paper. The results are colorful, informational, and fun. If you're a real geography whiz, maybe you'll even be able to determine where each piece came from. Where, for instance, can you find the City of

Gadsden, the Lookout Mountains, Black Creek, and Clayton Fish Pond?

Super Value Pack includes 115 pieces — assorted envelopes, paper sizes, and labels. \$14.95 ppd. from Forestsaver, P.O. Box 264, Dept. GM, Bayside, NY 11361; (800) 777-9886.



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Giggles for the Gardener

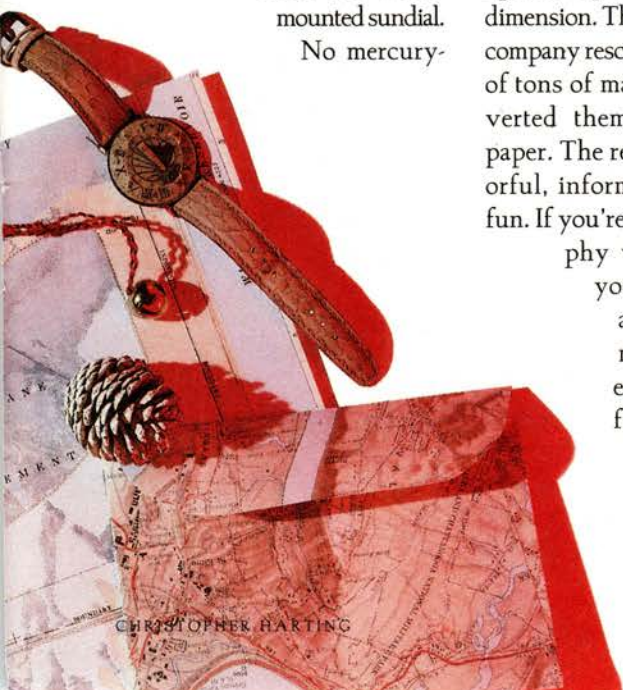
IF YOUR LOVED ONES ARE gardenally inclined, *Green Prints, The Weeder's Digest* is a must. This is gardening reading unlike any other. It has precious little to do with the finer points of open pollination or integrated pest management. If *Green Prints* has a mission, it's to cause the care-

worn gardener, whose tomatoes are aphid-blighted, whose children step on strawberries, and whose lettuce sustains a hoard of woodchucks, to laugh so hard she can't keep the razor blade steady against the wrist. Besides useful ads, each quarterly issue holds about 45 pages of light-hearted relief from the wearing duties of agricultural defense — essays on rocks, kids in the garden, a Venus fly trap on a hunger strike, and so on. Isn't your sense of humor worth \$14 a year? From *Green Prints*, P.O. Box 1355, Dept. GM, Fairview, NC 28730.

.....

Reclaimed Clipboard

THERE'S ANOTHER WAY TO write on garbage: a clipboard made from discarded electronic guts. Yes, it's a little lumpy due to the solder, but a couple sheets of paper cure that. Numonic Industries cuts the clipboards from the





defective or scrapped printed circuit boards of TVs, computers, switchboards, and the like. The edges are smoothed, the corners rounded, and a steel clip added. The result is a translucent jade-green (or occasionally blue) board laced with metallic squiggles. The company also makes loose-leaf binders.

Clipboard, \$11.99 ppd. from Numonic Industries, 4420 rue Ste. Catherine Ouest, Dept. GM, Westmount, Québec, Canada, H3Z 1R2; (514) 938-1281.

Lickable Lipstick

FOR HER: IF SHE'S GOING TO eat her lipstick (and if she wears it, she eats it), let's make sure it tastes good. Run-of-the-mill lipstick contains such delicacies as propylparaben, mineral oil, and aluminum dyes, and it tastes

reminiscent of melting crayons. Kiss My Face's new line of lipsticks is based on plant oils, spiked with skin-soothing vitamins E and A, and flavored with peppermint and spearmint oils. Even though these lipsticks feel slicker on the lips than most, they wear well, and taste wonderful. The bonus is that they won't dehydrate the kisser, as even the more-expensive lipsticks can. \$8 in health-food stores, or \$11 with shipping from (800) 262-KISS.

Earth-Saving Shaving

FOR HIM: FORGET THE LUNKY steel cans of shaving cream — even the "ozone friendly" brand. (Most aerosol products went CFC-free years ago.) Canned shaving cream is pressurized with the same hydrocarbons that contribute to ground-level smog — and it's expensive. Wean him off the stuff with a classic ceramic shaving mug, complete with a bristly brush, and three cakes of natural, glycer-

ine soap. Replacement shaving bars can be had at any drug store, wearing a fraction of the packaging that foam does.

\$27.55 ppd. (Calif. residents add 8.25 percent tax) from: Green Earth Products, 514 Maria St., Dept. GM, Redondo Beach, CA 90277; (800) 428-237.

Embracing Earth: New Views of Our Changing Planet

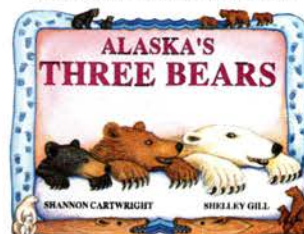
by Payson R. Stevens and Kevin W. Kelley. 176 pages. Chronicle Books, 275 Fifth St., San Francisco, CA 94103. Oversized hardcover, \$39.95. For mail order, call (800) 722-6657.

I'M NOT ONE TO SPEND \$40 on a book, but *Embracing Earth* is one of the most moving weddings of technology and nature that I've ever had the pleasure to attend. A collection of Earth images taken from above, the range and astounding beauty of these portraits are guaranteed to touch something in everyone. There are close-ups of massive rivers, mountain ranges, and volcanoes, computer-colored satellite shots of Pacific algae blooms and light pollution, and haunting images of hurricanes and sunrises seen

from space. From this perspective you quickly recognize the universal patterns of nature, and the notion, "It's so big we could never wreck it all," is replaced with a poignant sense of kinship and accountability.

Beautiful Bears

IF YOU'RE NEW TO SHELLEY Gill's kid's books on Alaska, get your toes wet in the company of Alaska's Three Bears. With illustrator Shannon Cartwright, Ms. Gill creates rich, beautiful pages that introduce kids to black, brown, and white bears, sharing a journey through Alaska. Besides the main narrative, there are extensive "footnotes" at the bottom of



each page for more advanced readers. Although the tone is bright and positive, Ms. Gill is matter-of-fact about the bears' taste for cute animals like seals and foxes.

Charlesbridge Publishing, 85 Main St., Dept. GM, Watertown, MA 02172. Soft/Hard: \$8.95/\$13.95 plus postage. (800) 225-3214.

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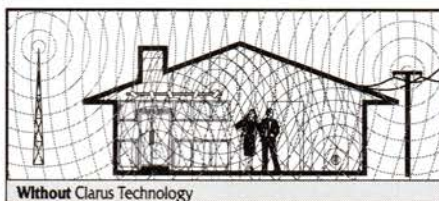
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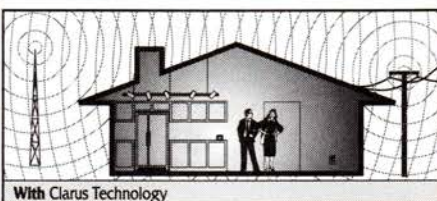
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DR. DAVID CARPENTER, Dean of the State University of New York
School of Public Health in Albany

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Our bodies have highly developed bio-magnetic energy fields within which millions of electrical impulses balance and regulate the activity of every living cell. In today's environments, we are continually subjected to random, disorder and spurious electromagnetic radiation (EMR) in our homes, cars and working environments.

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Steven Halpern, Ph.D., Musician, Educator

"I use Clarus Technology in my home and feel more peaceful and clear in my mind, body and emotions. It is important for each person to live in the most natural state possible for the greater good of all."

Terry Cole-Whittaker, Inspirational Speaker, Author

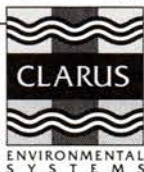
"I love having the CL-100 in the room where I do therapy. I notice that I feel refreshed at the end of the day instead of burned-out — and my clients seem to be more relaxed and emotionally open."

Miriam G. Keiffer, Ph.D., Licensed Psychologist

"Immediately after I plugged in the unit the office felt better. There seemed to be much less stress and resistance in the office. Everyone gets along better and are more productive"

Dennis Sullivan, Regional Mgr, Rogers Benefit Group

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A Bag to Suit Bikers

IT'S A PITY THE POLYESTER leisure suit no longer cuts it in the boardroom — now there was clothing you could wring out after biking to work, and still appear wrinkle-free. At least now you can pack the woolen pinstripes in a bag that's designed to keep them on the straight and narrow whether you bike, walk, or rollerblade to work. The Backrider is built like a garment bag, but rigged like a backpack. You hang your suits and dresses in it, fold it in thirds, and strap it on. There's a leather carrying handle, too.



The Always Calendar

APTLY NAMED, THIS CALENDAR will be up to date until some future tribe changes the names of the months. How did they do it? The calendar is a big magnet, and you rear-

range the month names and the days as time goes by. The days are arranged in strips, so you move only seven strips, not 31 squares; the last few days of the month are separate so you can stick them face-down in the appropriate months. Red: #15RWXR. White: #15WBXR. Gray: #15GWXR. \$13 ppd from Slencil Company, P.O. Box 210, Dept. GM, Orange, MA 01364-0210.

Home, Elegant Home

BESIDES LOOKING GOOD ON the coffee table, this big book may rub off on the rest of your house. **G**ARBAGE editor emeritus Janet Marinelli and current contributor Robert Kourik poke their heads — and cameras — into some of the most beautiful, environmentally sensitive houses in the nation, and then guide you through the design of your very own naturally elegant house. There are sections on every part of the house, bathroom to kitchen, as well as the garden, landscaping, and sun space.

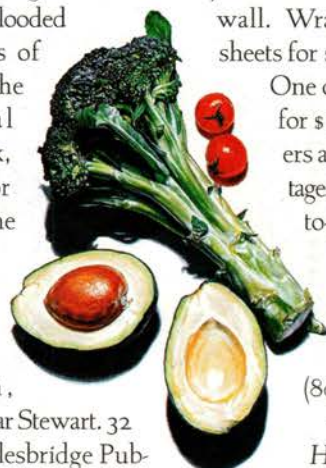
The Naturally Elegant Home: Comfort, Ecology, and Style in America's New Environmental Houses and Gardens. Roughly 250 pages. In stores November 19. \$45 plus shipping from Little, Brown and Company, 200 West St., Waltham, MA 02154; (800) 343-9204.



Great Gardening for Kids

CITY AND COUNTRY MICE alike will enjoy the harvest in *The Victory Garden Alphabet Book*. The alphabet and the short passage that goes with each vegetable become almost a sidelight to the bright, sun-flooded illustrations of kids (plus the occasional woodchuck, raccoon, or toad) in the garden.

By Jerry Pallotta and Bob Thomson, illus. by Edgar Stewart. 32 pages. Charlesbridge Pub-



lishing, 85 Main St., Dept. GM, Watertown, MA 02172. Soft/hard: \$6.95/\$14.95 plus postage. (800) 225-3214.

And That's a Wrap!

SHOPPING DONE, IT'S TIME to wrap. A couple of new ways to hide gifts:

The Permapag: Keep an eye out for local cottage-industrialists who sew pretty, fabric gift bags. For mail order, try TMW Enterprises, 102 North Broad St., Dept. GM, Brevard, NC 28712. Ask for a catalog of these gorgeous, nature-related bags with drawstring sewn in.

The Mapwrap people have outdone themselves with the new Tropical Eco-Series: five stunning rain-forest scenes. Both cards and wrap have 50 percent recycled content with 10 percent post-consumer. Wrap and un-wrap carefully, and you'll have a poster for the wall. Wrapping: Two sheets for \$2.50. Cards:

One of each design for \$7.50. All orders add \$3.00 postage. Northern Cartographic, P.O. Box 133, Dept. GM, Burlington, VT, 05402; (802) 860-2886.

— Reviews by Hannah Holmes



Ready for Rural Recycling?

WE WANT TO LAUNCH A RECYCLING PROGRAM IN OUR rural community. What collection method works best, curbside or drop-off, and how are recyclables sold once collected?

JILL BROOKS
Cumming, GA

are so contaminated that they cannot be sold, you won't gross enough to cover your costs.

Recycled Plastic? Can't Bag It

Why won't the FDA let us use bags of recycled plastic for our organic-produce stand?

CHAD DEAL
Kilauea, Hawaii

BECAUSE "RURAL" VARIES WIDELY THROUGHOUT the country, it's helpful to find a town similar to your own which is already recycling. Use it as a role model. You can also educate yourself about recycling by going to the library and finding back issues of trade magazines (like *BioCycle* and *Resource Recycling*) that cover waste management. Or try calling the National Association of Towns and Townships, (202) 737-5200; the organization provides technical information on setting up rural recycling programs.

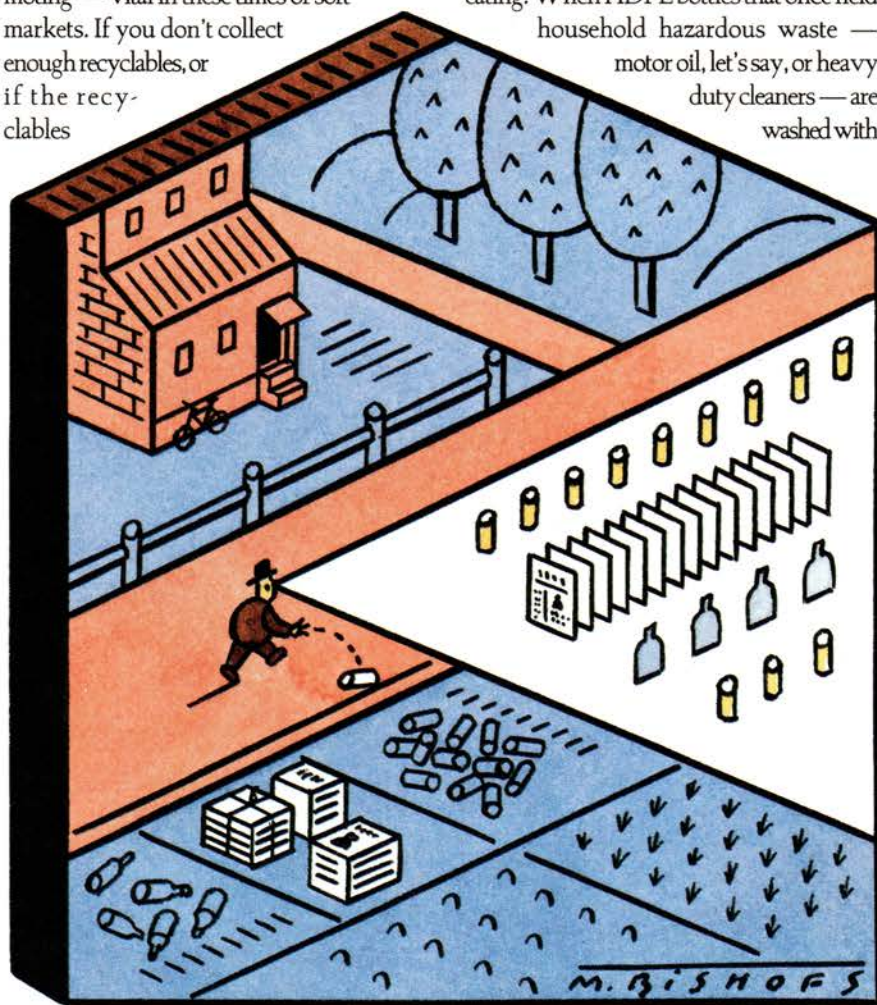
If residents are accustomed to taking their trash to the municipal or county dump, then set up a drop-off recycling center in that area. Before you start collecting, contract with recycling brokers to take the stuff off your hands. (Brokers provide the containers and sell the recyclables.) Expect to pay fees for renting containers and hauling them away to be weighed. After expenses are subtracted from the recyclables' cashed-in value, you and brokers split the net — should there be any. Though most analysts predict that things will improve, right now the markets are weak for many recyclable materials.

Typically, any scrap-metal broker (every county has at least one) will buy aluminum and steel cans. Many brokers also handle glass, especially if your area has restaurants and bars. Newspaper, office paper, and corrugated cardboard recycling is almost always done by a company that handles paper only. If recycled at all, plastics are usually han-

dled by general scrap (or metal) recyclers.

Volunteers get the recycling program off the ground and do the educating and promoting — vital in these times of soft markets. If you don't collect enough recyclables, or if the recyclables

THE FDA IS CONCERNED BECAUSE THE USUAL method of recycling plastic can also recycle chemical contaminants we ought not to be eating. When HDPE bottles that once held household hazardous waste — motor oil, let's say, or heavy duty cleaners — are washed with



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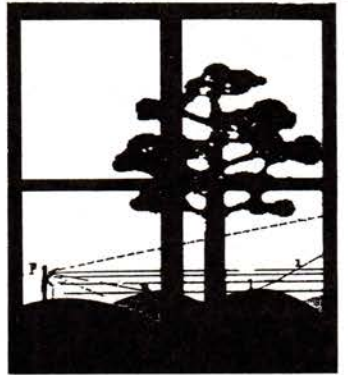
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Martin W. Lewis

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288 pages, cloth \$24.95

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detergent and then ground into pellets for recycling, residue from the oil or cleaner may stick around. Also, recycled plastics are sometimes mixed with resins that wouldn't meet FDA approval for contact with food, even as virgin material.

The single way for a processor to kick every iota of contaminant out of recycled plastic is to undo the plastic down to its prepolymerized hydrogen and carbon molecules so that anything non-plastic (like contaminants) falls aside. Molecular magic like this does not come cheap. Only a few mega companies such as Coca Cola and Pepsi have employed methods of recycling plastic that satisfy the FDA's definition of clean; such pop bottles are available in limited areas.

To "do your part," encourage customers to bring tote bags or sacks from home — you might even give them a discount for their BYOs. Or ask customers to collect bags from their shopping errands at other stores and bring them to your stand. This fosters reuse and saves you money on bag purchases.

Greener Cleaner Uppers

None of the environmentally friendly laundry detergents which I've used gets out tough stains. Any suggestions?

WILL KLEEMAN
Nashua, N.H.

THE ENVIRONMENTAL EVALUATION OF REGULAR laundry detergents focuses mainly on phosphates, synthetic surfactants, bio-degradability, and chlorine.

Phosphates help soften water and boost your detergent's cleaning power. But when wastewater laden with phosphates reaches lakes, it fertilizes algae so they reproduce ad infinitum until oxygen is depleted, killing aquatic critters.

To replace phosphates, most manufacturers of regular detergent add three to four times more synthetic surfactants; these are derived from petroleum and biodegrade extremely slowly, adding a heavy load to sewage- and water-treatment plants.

Chlorine's bad rap comes from its propensity to produce (when in contact with organic matter) various organochlorine compounds which have been implicated as carcinogens. Chlorine-laden wastewater occasionally over-accumulates in lakes and streams,

wiping them clean of beneficial organisms.

So-called "environmental" detergents use cleaners and surfactants derived from fatty acids in the saturated oils of coconuts and palm kernels. These, along with alkaline mineral compounds such as soda ash, supply most of the cleaning power. Citrus-oil extracts are often added for extra zap. Since fatty-acid based cleaners work less effectively in hard water, such detergents usually include water-softening additives. These additives increase the salinity of wastewater — which doesn't bother treatment plants but is tough on septic.

Of those I've tried, my favorite in terms of cleaning power is by Kid's World; currently available outside of North Texas only by mail-order: (214) 361-3650. Unlike most other brands, it has plant-based enzymes, great for households with kids and pets (and their heavy-duty stains). Bio Pac [(207) 785-2855] is available in liquid and powder, usually through bulk dispensers at stores; the powder has terrific cleaning power and the liquid is far less expensive than other similar brands. From Belgium comes one of the leading brands, Ecover: (203) 853-4166. Very mild on clothes and lower than most detergents in mineral salts, Ecover's cleaning power is also mild.

Of the regular detergents, the greenest is probably Arm & Hammer's Ultra Fresh. Like most major brands, it's phosphate free. But it includes synthetic whiteners and fragrances, which sometimes remain in the fabric to irritate the skin of babies and other sensitive types. Definitely heavy duty.

A few stain-usurping tips accrued from 30 years of laundry detail: Always first dissolve detergent and additives in the washing machine before adding dirties. Increase washing time, water temperature, and agitation speed as much as tolerable; or run heavily soiled fabrics through the washing machine twice before drying. (Remember that this will use more water and energy.) And of course, pre-treat stains whenever possible by soaking with concentrated liquid detergent or a paste made from powdered detergent, laundry additives, and a sprinkle of water.

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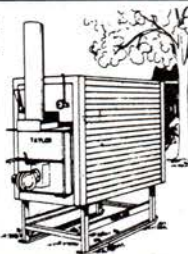


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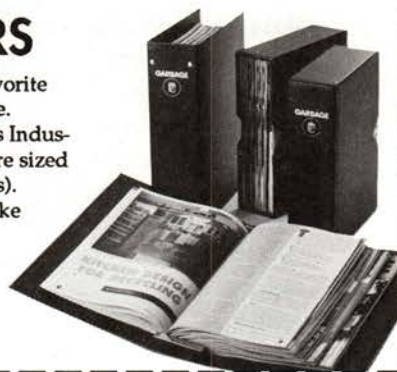
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Dumparoo for the Dunkaroos

PACKAGING GURU JUDD ALEXANDER* EXPLAINS THE MERITS of packaging in his upcoming book *In Defense of Garbage* (Greenwood Publishing). Still, a few conspicuously bad examples of packaging — where waste and misrepresentation grossly overshadow protection and hygiene — can give the whole industry a bad name. ¶ Betty Crocker wins our

back-page booby prize this time, for filling the cookie jar with garbage. That's garbage as in trash, as in junk food, and as in bull-cookies. Dunkaroos got us going.

Inside the cardboard box you'll find six plastic trays, each sealed with a plastic/foil lid. Tiny cookies (ten of them, 1/2 ounce, in each tray) rattle around; each tray also holds a 1/2-ounce blob of slimy icing. The more-or-less digestible material in the box totals just 6 ounces, and comes to you in 2.3 ounces of packaging. Packaged alone, the cookies would fill 3/16 — less than a quarter — of a normal graham-

cracker box; the icing would take up the same fraction of a tub of ready-to-spread frosting.

The real sin of the packaging is that it disguises the fact you're paying almost \$6 a pound for these cookies. And "they've taken a good food and turned it into a junk food," complains Jayne Hurley of the Center for Science in the Public Interest: Although the box boasts "graham cookies," high-fiber, high-vitamin graham flour

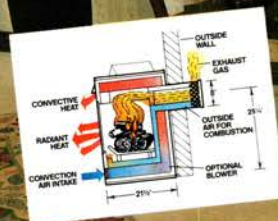
gets fifth place on the list of ingredients, after white flour, sugar, oils, and honey. The icing is essentially sugar and fat.

"Kids love snacks that have action associated with them," General Mills' spokeswoman explained to *Ad Age*, a trade magazine. Uh-huh. Whatever happened to spreading peanut butter on celery?

Speaking of selling garbage to kids... Dis-honorable mention to BertSterm Products, Inc.'s deodorant for kids. As if the notion of pushing deodorant on children isn't adequately ridiculous, Fun 'n Fresh offends by making pretenses of environmental "friendliness." Many adult products are sold naked now, without an outer box, but this one has the secondary packaging, perhaps so the marketing department would have room to tout "natural" in its usual meaningless, unregulated sense. (Read the list of ingredients, and tell us what it means.)

*Judd Alexander is the former executive vice president of both the American National Can Company and the James River Corporation.





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*Remodeling Contractor Magazine, Cost VS. Value Report, May 1987, 1988, 1989.

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ther·mal re·cy·cl·ing, *euphemism*— A process whereby garbage is burned ("thermal") and turned into power ("recycling"). A furnace transfers the thermal energy from hot gases to water in a boiler; the resulting steam turns a turbine and generates electricity.

According to Martin Melosi's book *Garbage in the Cities* (Texas A&M University Press), the ancestor of the modern trash burner was built in 1876 in Manchester, England, by the aptly named Alfred Fryer. Dubbed the "Destructor," it promised to reduce and "purify" combustibles. The Boston Health Dept. even urged that models be adapted to burn waste in home kitchens.

As we know, first-generation incinerators were smoky, gassy things that often failed to completely burn soggy garbage. Technological advances nevertheless allowed incineration to remain a long-standing disposal method. By the 1970s, as oil prices climbed and concerns mounted over dumping, burning was here to stay.

But because of its troubled history, "incineration" was a dirty word. What to do about that name? The May 1970 issue of the trade magazine *Waste Age* argued for a solution: "To complete the transition from a dirty, smelly, necessary evil to a modern, industrial-type plant, the time has come to drop 'incinerator' and ... adopt another term..." And so we got "waste-to-energy" plants. Garbage burning and energy recovery were linked.

Of course, incineration remains the most controversial method of waste disposal. So the name game continues.

Nissan Motors boasted of its "thermal-recycling" program in a new brochure. The carmaker's spokesman had a hard time keeping a straight face as he pronounced, "It is indeed a form of recycling — recycling material into energy." But then he couldn't help suggesting that landfilled garbage might as well be called "ski-slope recycling."

